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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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02 AERODYNAMICS

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For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 1933

02 AERODYNAMICS 1933

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 1941

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 1941

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 1943

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 1945

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 1946

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

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08 AIRCRAFT STABILITY AND CONTROL N.A.

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 1948

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 1950

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13 ASTRODYNAMICS 1959

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) 1959

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

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15 LAUNCH VEHICLES AND SPACE VEHICLES 1960

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 1962

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING N.A.

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 1963

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19 SPACECRAFT INSTRUMENTATION N.A.
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20 SPACECRAFT PROPULSION AND POWER 1963
Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.
For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

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23 CHEMISTRY AND MATERIALS (GENERAL) 1965
Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 1966
Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 1967
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 1971
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 1974
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28 PROPELLANTS AND FUELS 1975
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

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Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics*.

31 ENGINEERING (GENERAL) 1978
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 1979
Includes land and global communications; communications theory; and optical communications.
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39 STRUCTURAL MECHANICS 2004
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Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
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85 URBAN TECHNOLOGY AND TRANSPORTATION 2064
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2065
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2066
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2066
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 2067
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2067
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 2068

Note: N.A. means that no abstracts were assigned to this category for this issue.

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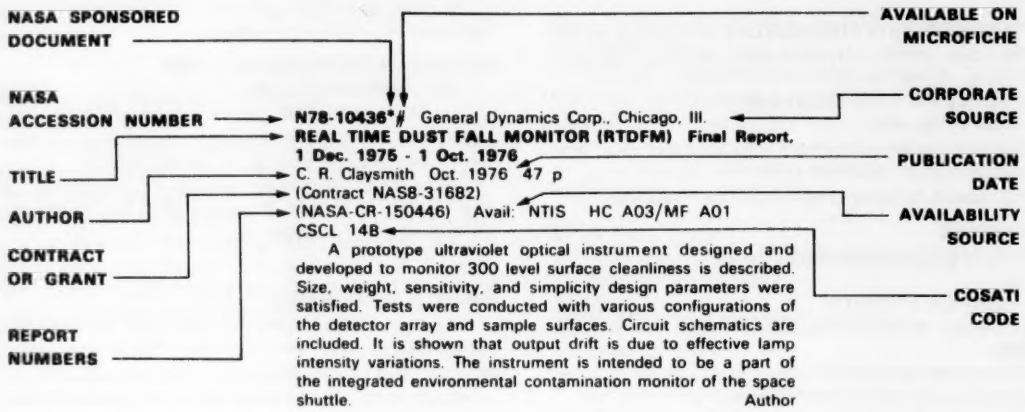
TYPICAL CITATION AND ABSTRACT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NASA ACCESSION NUMBER
N78-10436*# General Dynamics Corp., Chicago, Ill.
CORPORATE SOURCE
REAL TIME DUST FALL MONITOR (RTDFM) Final Report, 1 Dec. 1975 - 1 Oct. 1976
TITLE
C. R. Claysmith Oct. 1976 47 p
PUBLICATION DATE
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(Contract NAS8-31682)
(NASA-CR-150446) Avail: NTIS HC A03/MF A01
AVAILABILITY SOURCE
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REPORT NUMBERS
A prototype ultraviolet optical instrument designed and developed to monitor 300 level surface cleanliness is described. Size, weight, sensitivity, and simplicity design parameters were satisfied. Tests were conducted with various configurations of the detector array and sample surfaces. Circuit schematics are included. It is shown that output drift is due to effective lamp intensity variations. The instrument is intended to be a part of the integrated environmental contamination monitor of the space shuttle.
Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects— not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, LARGE AREA COMPOSITE STRUCTURE REPAIR

R.W. KIGER, Northrop Corporation, *Hawthorne, California* 90250 (DF135810; F33615-76-C-3017)

Advanced composite structural components are now in limited use on military aircraft. Future weapon systems will use composite structural materials in wider applications. Required criteria, techniques and facilities for depot level repair do not exist. This effort will develop and provide needed criteria and techniques to perform cost-effective repair which will minimize life-cycle costs.

Cost-effective depot level repair criteria and techniques applicable to large area advanced composite structure on military aircraft will be developed. A review of advanced composite structure technology and the operations, facilities and capabilities of AFLC maintenance and repair depots will be followed by an in-depth study and analysis of the unique problems encountered in the repair of large area composite structures. A number of specific repairs will be made on which structural tests will be conducted.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0002, FLIGHT/PROPULSION CONTROL COUPLING AND DYNAMIC INTERACTION

R.L. HEIMGOLD, Lockheed Electronics Co. Inc., *Los Angeles, California* (DF138280; F33615-76-C-3128)

Currently, suitable techniques are not available for analysis and synthesis of dynamic interactions between flight and propulsion controllers on military aircraft, for purposes of developing control coupling techniques. The objective of this program is to develop methods and data base for design and implementation of flight/propulsion control coupling (FPCC) systems in fighter aircraft. In flight-propulsion control coupling, functional control parameters and system elements are blended to enable cooperative dynamic operation, with potential dramatic improvements in maneuverability, agility, air superiority, and airframe-propulsion compatibility. Jet flap and vector thrust classes of aircraft are to be considered.

The program will extend and refine the preliminary design of combat flight control modes for the jet flap aircraft which was developed in project 19870254. Emphasis will be on deceleration and turning modes, and integration with aircraft and engine stability loops. The areas of control, aerodynamic, and functional interaction between propulsion system, control surfaces, and airframe will be identified by review of past and current research and development, and problem areas experienced on modern military aircraft in the inventory. Maximum utilization will be made of available control technology and computer simulations in the respective areas of aerodynamics, flight control, and propulsion dynamic analysis to develop the analytical tools for evaluation of control interaction. Detailed analysis and simulation will be performed on the configuration selected, to define interaction parameters, and generate control coupling requirements. Plans for flight demonstration will be outlined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, THE RESONANCE PHENOMENON OF A JET IMPINGING ON A SOLID BOUNDARY

C. HO, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (DF048550; AF-AFOSR-3312-77)

AF function - advanced aerospace vehicles. Opportunity - when a solid surface is located closer than six jet diameters from a high subsonic (above Mach equals 0.6) a resonance phenomenon appears in the form of increased noise level and increased energy transfer from the jet to the solid surface. The present theories are incomplete and inadequate to explain this phenomenon. The large-scale coherent structure shed from the nozzle is speculated to be the generating mechanism, and this research is designed to prove or disprove this conjecture. Objective -experimentally investigate this phenomenon to obtain a basic understanding of the resonance mechanisms. How work contributes - the operation of STOL aircraft uses jet exhaust impinging on the flap system to generate additional lift, and this is closely approximated by this research configuration. The noise increase could affect the environmental impact of future Air Force operations and the increased energy transfer from the jet to the wing flap system could affect the structural integrity of the aircraft. Understanding of this resonant phenomenon and quantitative data are needed to enable more efficient design of the blown flap system.

Experimental configurations of an axisymmetrical jet (heated and unheated) impinging on a large flat plate normal to the axis of the jet will be investigated in an anechoic chamber. Conditional sampling data of pressure fluctuations, temperature fluctuation and heat transfer rates on the plate along with the far field noise will be measured and analyzed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0004, DEVELOPMENT OF SUPERSONIC STORE SEPARATION METHOD FOR NON-CIRCULAR AIRCRAFT

J.N. NIELSEN, Nielsen Engin. & Research Inc., *Mountain View, California* 94040 (DF137080; F33615-76-C-3077)

Combat effectiveness of military aircraft has decreased over the years. The objective of this effort is to increase combat effectiveness of future systems by developing an analytical tool through which store separation may be factored into the total system design. Using the tool to be developed under this work effort, self-inflicted damage can be reduced as well as increasing the safe release envelop of future systems. A method to mathmatically model the flow field in the region near realistic supersonic aircraft will be developed and used to predict store separation trajectories.

The approach will develop an analytical method in conjunction with an experimental program. The analytical effort will involve development of mathematical models for the flow fields around realistic fighter-bomber type aircraft. Next, an experimental program to gather flow field data will be conducted in tunnel A at AEDC. Finally, this data will be used to refine and substantiate the methods developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, HIGH-TEMPERATURE ROTOR HYDRAULIC ACTUATOR FOR HIGH-PERFORMANCE AIRCRAFT
R.K. VANAUSDAL, Bendix Corporation, *North Hollywood, California* 91605 (DF452860; F33615-72-C-1187)

To establish rotary hydraulic actuator techniques for use at ambient temperatures over 800 F.

The approach will consist of (1) evaluation of seals, cooling methods, high-temperature materials, and actuator designs, (2) fabrication of seal test rig and design and test of high-temperature rotary seals, (3) investigation of cooling methods, (4) design and fabrication of actuators, (5) high-temperature testing and evaluation, and (6) preparation and delivery of a final report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0006, FLEXLODS - BLENDED WING/BODY
J.J. HOSEK, General Dynamics Corporation, *Pomona, California* 91766 (DF139800; F33615-77-C-3030)

The accurate prediction of loads on any aircraft configuration utilizing multiple lifting surfaces is one of the most difficult problems that the structural loads engineer encounters. This is especially true with the introduction of new technologies such as wing-body blending, vortex lift, variable camber, supercritical airfoils, and advanced flight control concepts. This program shall be one of assessing the most advanced theoretical aerodynamic operators and load prediction techniques that can be used in accurately predicting the structural loads for advanced flight vehicles utilizing known advanced design technologies. Extensive use of configurations utilizing the above technology advancements will be covered and the load prediction techniques evaluated as to their credibility for use in design and evaluation.

In recent years the aerodynamic loads theories based on finite element approaches provided significant advances in the state-of-the-art for predicting interference effects such as those produced by wing-body-tail and/or external stores. Currently there are two well-known methods available which have the capability for predicting the aerodynamic pressures involving multiple surfaces and external stores. These are (1) doublet lattice and (2) Woodward method. Recent methods that are an improvement over those above have been developed but they do not include external store effects. These are (1) improved Woodward method and (2) effect of symmetrical vortex shedding on longitudinal aerodynamic characteristics of wing-body-tail combinations. The former two methods are routinely used in all phases of design. However, neither method has been extensively evaluated as to its general capability for predicting accurately the pressure distribution on configurations employing advance technologies. A systematic comparison will be made of the methods discussed above with experimental data on a variety of aircraft configurations that employ new technologies such as wing-body blending, variable camber, lifting body concepts. These comparisons are to be made at design maneuver loads throughout MIL-A-008860 (USAF) V-N diagram requirements. The results will be collected into a single report and evaluations made on the basis of accuracy and stability for various classification of problems. Necessary corrections will be made to the aerodynamics and/or structural loads prediction modules of the FLEXLODS computer program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0007, STRUCTURAL LIFE PREDICTION AND ANALYSIS TECHNOLOGY
T. CRUISE, United Technologies Corp., *Hartford, Connecticut* 06108 (DF458060; F33615-75-C-2063)

The objective of this program is to develop specific and accurate life prediction/analysis computer techniques for aircraft gas turbine engine components. The programs developed will be verified through testing and include capabilities for consideration of all necessary facets of mechanical and thermal cyclic fatigue. All programs will run on the WPAFB computer system and will be versatile so as to be able to analyze all types of engine component designs and materials.

This effort consists of developing under contract with major engine manufacturers a series of programs, related and integrated with existing AFAPL stress analysis programs, to predict component fatigue life. included in the analysis will be effects of loading order, loading history, dwell time, material hysteresis as well as interactive effects of creep, and plasticity. Each analysis will be verified through actual component testing as well as specimen testing to ensure accurate analytical techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0008, PROVIDE MOVING TARGET DETECTOR (MTD II)
UNKNOWN, U.S. Air Force, *Washington, District of Columbia* 20330 (FATQWAI-679; FA059979 (TRAIS NO.))

The objective is to provide an operationally configured Moving Target Detector (MTD II) to be used in a field evaluation at an Airport Surveillance Radar (ASR) site. The MTD-II will have a capability equal to or better than the original MTD in aircraft detection and false alarm rejection in the clear and in precipitation, ground, and angle clutter environments. The first phase shall consist of the design, fabrication and test of the MTD-II. The second phase shall consist of the installation and checkout of the MTD-II at the field site, and support for the field evaluation.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0009, DYNAMIC RESPONSE OF PNEUMATIC TIRES WITH REFERENCE TO AIRPLANE BRAKE CONTROL
A.F. DSOUZA, Illinois Inst. of Technology, School of Engin. & Phys. Sci., *Chicago, Illinois* 60616 (DF050000; AF-AFOSR-3447-77)

AF function - improvements in aeromechanical elements, critical subsystems and component of flight vehicles are necessary in order to continue the success of aerospace vehicles to perform as required. Deficiency - inadequate models exist of tire friction and wear and tire interactions with braking devices. Objective - the objective of this research is to develop kinetic and kinematic models of tire behavior during landing. How work contributes - research is ancillary to experimental research program being conducted in-house at AFFDL.

Mathematical simulation of tire response during cross wind landings will be developed. Model will include dynamic forces and viscoelastic tire characteristics. Linear differential operator relationship between deformations and stress will be assumed. The dependence of the peak braking force on the tire properties will be investigated by parametric sensitivity analysis. Parameter optimization will be examined with respect to desirable tire characteristics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0010, UH-1B TAIL BOOM FINITE-ELEMENT MODEL
E.S. CRISCIONE, Kaman Corporation, *Burlington, Massachusetts* 08103 (DA0N4547; DAAD05-76-C-0763)

To construct a finite-element model of the UH-1B helicopter tail boom for use with the nastran computer program.

The uh-1b helicopter tail boom will be modeled as a collection of beams and plate elements.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Labs.

1.0011, FIRE SUPPRESSION AND CONTROL FOR AIRCRAFT SURVIVABILITY
S. ATALLAH, Arthur D. Little Incorporated, *Cambridge, Massachusetts* 02142 (DF460210; F33615-76-C-2127)

To develop a capability for suppression and control of fires in areas of an aircraft where the potential for combustible fluid leakage, high airflow and high temperature or other ignition sources co-exist. Primary emphasis is on the engine/nacelle fire problem.

The program will develop and evaluate material(s) and concept(s) to provide rapid initial extinguishment of an engine/nacelle fire and prevent its reignition in the high-airflow,

high-temperature environment of advanced aircraft engine nacelles. This development will be accomplished in five steps or tasks as follows: (1) state-of-the-art review, (2) develop test plan, design screening test and establish acceptance criteria, (3) conduct preliminary screening tests, (4) selection and evaluation of candidate materials and system concepts, (5) trade-off analysis of system concepts. Potential application to dry bay areas of advanced aircraft will also be considered.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0012, ENGINEERING SUPPORT FOR PROTOTYPE ADVANCED MEDIUM STOL TRANSPORT (AMST) AIRCRAFT

P.J. MACEK, U.S. Army, Natick Research & Dev. Command, *Natick, Massachusetts* 01760 (DA0G4256)

Supplement the AMST Army Coordination Office with engineering and technical support for the airdrop test program of two prototype aircraft (Boeing YC-14 and the McDonnell-Douglas YC-15). Assist in the preparation of the AMC Headquarters AMST assessment plan. Review Air Force and contractor plans of test to assure that critical Army interest areas are considered. Assist in the design of specific tests and in the preparation of flight test cards. Monitor and participate in the scheduled airdrop flight test programs. Evaluate test results and furnish the Army Coordination Office with an engineering test report.

Prepare assessment plans, review test plans, prepare flight test cards and recommend test designs which will insure recording of test results required by the Army in its engineering evaluation of two AMST prototypes. Review films, telemetry traces and anetheodolite trajectory space positioning reports to determine the adequacy of the AMST prototypes as airdrop aircraft in support of the Army's airborne assault mission.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

1.0013, CRASHWORTHINESS AND OCCUPANT PROTECTION IN GENERAL AVIATION AIRCRAFT ACCIDENTS

R.G. SNYDER, Univ. of Michigan, Highway Safety Research Inst., *Ann Arbor, Michigan* 48105 (106343 (HRB NO.))

OBJECTIVE: To determine relationships between injury patterns and crashworthiness design. Significance: These investigations, conducted since 1970, are being pursued in cooperation with the National Transportation Safety Board, the Federal Aviation Administration, and the Michigan State police. The on-scene investigations provide the kind of biomedical data essential for safer designs of aircraft, particularly with respect to improved protection during and following a crash. Methods: In on-scene investigations of survivable crashes, investigators examine and evaluate the performance of cabin structures, instrument panels, restraint systems, seats, and other components relative to occupant injury or protection. Results: Data collected thus far indicate that even when cabin structures remain intact, occupants often receive serious or fatal injuries from instrument panel projections, inadequate restraint systems, inadequately anchored seats, and other design-related causes. The data show that use of upper torso restraints could reduce serious and fatal injuries in survivable accidents by an estimated 85%. The data also show that emergency general aviation aircraft ditching can be successfully accomplished under adverse conditions, with overall 95% survivability found for 315 cases in the past 10 years.

SUPPORTED BY University of Michigan

1.0014, ADVANCED COMPOSITE WING COVER-TO-SUBSTRUCTURE ATTACHMENT DEVELOPMENT PROGRAM

H.H. FORSCH, Grumman Corporation, *Bethpage, New York* 11714 (DF140120; F33615-77-C-3071)

Advanced composites exhibit considerable potential for performance and cost benefits in primary airframe members of Air Force aircraft. A key problem exists in the design and manufacture of critical structural details such as the the lower wing cover/substructure joint where it is particularly desirable to eliminate fasteners to improve structural efficiency, increase airframe life, simplify fuel sealing techniques and reduce fabrication costs. The objective of this program is to develop, evaluate and verify advanced composite structural design concepts for wet-wing military aircraft featuring non-mechanical attachment of substructure to covers, repairable fuel sealing concepts and revised, low-cost final assembly procedures. Demonstration of the structural integrity of such advanced structural joints with their attendent system benefits will provide future airframe designers and producers with viable options for improving performance and reducing costs of advanced military aircraft.

Four cover-to-substructure design concepts will be designed, evaluated and compared with a typical mechanical joint designed to the same loading conditions during the first phase of this program. approximately 81 test specimens will be tested at three temperatures to provide comparative test data, 27 each at minus 67 F, RT and 300 F. Thermoplastic resin systems will also be evaluated to provide repairable fuel tight sealing capability. Phase 2 involves design and fabrication of a 2 foot by 3 foot test box utilizing the selected concept. During phase 3 the box will be tested under the combined effects of fuel pressure and torsion introduced by the closure ribs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, DEVELOPMENT OF DIRECT-DRIVE CONTROL VALVE FOR FLY-BY-WIRE FLIGHT CONTROL SYSTEM ACTUATORS

J.E. RINDE, General Electric Company, *Binghamton, New York* 13902 (DF136700; F33615-76-C-3037)

Present aircraft utilizing fly-by-wire (FBW) flight control systems use separate 'secondary actuators' to drive the main control valves of the flight control surface actuators. These secondary actuators are complex, heavy, and costly utilizing contamination sensitive, low-force, electro-hydraulic 'pre-amp' spools and contain single point failure mechanical elements. The objective of this effort is to mechanize and demonstrate the viability of a direct valve drive mechanization utilizing high-force transducers as a practical and effective means of reducing FBW servomechanism complexity, weight, and cost.

A program will be conducted to develop a device wherein the main actuator control valve is directly driven by high-force output transducers for fly-by-wire system applications. The valve shall contain a conventional dual tandem spool driven by two transducers. The unit and its control loop shall be a single-fail operate system. The program shall consist of (1) design study to determine optimum transducer/valve combination, (2) design of experimental valve/valve driven unit for assembly on existing dualized actuator, (3) fabrication of bench model, (4) laboratory testing, (5) prepare interim report, (6) complete final designs, fabricate, and assemble three flightworthy units. Each unit includes the direct-drive module assembled to the modified GFE servoactuator, and the electronic control module, (7) conduct flightworthiness tests, (8) develop plans in accordance with MIL-P-27733 to insure aircraft compatibility for possible flight testing and (9) prepare final report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0016, TURBINE ENGINE EXHAUST NOZZLE PERFORMANCE INVESTIGATION

D.A. DUSA, General Electric Company, *Cincinnati, Ohio* 45215 (DF455850; F33615-73-C-2037)

The objective of this program is to assess the potential for use of various plug nozzle types in advanced integrated propulsion systems of the future. In particular, the contractor will define external and internal flow characteristics and performance of promising plug nozzle designs installed in afterbodies of advanced design.

Phase I, design studies of various plug nozzle types and afterbody shapes for use in advanced technology engines. Phase II, fabrication and testing of the most promising of these configurations. Phase III, definition of follow-on full simulation testing program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0017, ACTIVE FLUTTER SUPPRESSION APPLICATION
L.J. HUTTSELL, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF140410)

High-performance fighter-attack aircraft are required to carry many combinations of external wing mounted stores to obtain operational effectiveness. However, some wing/store configurations are found to be critical from the standpoint of preventing flutter from occurring within the desired operational flight envelope. Speed placards are the only suitable means of preventing this flutter, but this technique generally results in significant losses in aircraft performance. The objective of this program is to investigate via analyses the capability of various flutter suppression schemes.

Analyses will be conducted on the wing-store flutter suppression models developed under AFFDL contract to verify the control system design and to determine alternate compensation schemes. Along with the analytical effort, ground tests will be conducted on the flutter suppression model to verify the model and control system dynamics and to provide data to update the analyses. Analyses will be also conducted on other configurations (e.g., bending-torsion flutter) to provide a basis for future wind-tunnel tests.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0018, EXPERIMENTAL FATIGUE PROGRAMMING AND CONTROL USING A MINICOMPUTER ON STRUCTURES TEST
N.K. MONDOL, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF130760)

The investigation for proof of USAF aircraft structural integrity includes fatigue testing an airframe in a laboratory to locate and fix fatigue critical structure to preclude catastrophic failures in service operation. Current closed-loop systems used for fatigue testing require one null balance load controller for each load channel. Complex test set-ups can require 100 or more controllers at a cost of approximately $2,500 per controller. The objective of this effort is to reduce test system costs, and increase test system reliability, by using minicomputers in a direct digital control system to replace both the load controllers and function generators used for programming loads. Success in this effort will save money, time and manpower and decrease system complexity when compared to present systems. These benefits can be realized by the AMAVS fatigue test program if this effort is adequately demonstrated in a timely manner.

Continued development requires the services of a specialist for assistance in the development of special software. With this assistance, two minicomputers will be linked so that one generates functions, communicates information to the test engineer and coordinates while the other performs the closed loop digital load control. The completed test programming and control system will be evaluated on a test beam designed to simulate an aircraft wing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, AIRCRAFT ENGINE NACELLE FIRE TEST SIMULATOR
UNKNOWN, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (FA76WAI-626; FA059103 (TRAIS NO.))

High-performance aircraft with their advanced propulsion systems and extended flight environmental conditions will require delineation of effective fire prevention and control measures. Full-scale engine nacelle installations will not be available for the determination of fire protection criteria and evaluation of fire protection equipment performance. Consequently, a means for simulating anticipated conditions and the evaluation of advanced fire protection measures is necessary. The objective of this program is to provide an aircraft engine nacelle simulator which will allow realistic investigation of engine nacelle fire problems and the evaluation of fire prevention, detection, and extinguishant systems generated by other programs.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0020, SUBSONIC DIFFUSER INVESTIGATION
W. SIMPKIN, Ling Temco Vought Incorporated, *Dallas, Texas* (DF133550; F33615-74-C-3104)

The subsonic diffuser is an important and integral part of a transonic/supersonic inlet system for current and advanced military aircraft. This component must be carefully designed to achieve satisfactory inlet performance and inlet-engine compatibility. A continual upgrading and refinement of design criteria and exploration of new diffuser concepts is required to advance technology and reduce development and acquisition costs in future aircraft.

Using government furnished subsonic diffuser test hardware, additional design data, analyses and correlation will be generated for use in inlet preliminary design and performance evaluations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0021, MULTIVARIABLE DIGITAL CONTROL SYSTEMS
B. PORTER, Univ. of Salford, *Salford, England, United Kingdom* (DF138790; AF-AFOSR-3005-76)

The Air Force is currently developing the use of the digital computer for flight control management. For the digital computer to solve real-time flight control equations, the computer must solve the equations in the time domain (rather than the frequency domain). The objective of the study is to analyze the real-time implementation of disturbance-rejection and tracking control policies using digital computers. The proposed effort is to develop high-performance multivariable digital control systems whose functions are simultaneously to reject external disturbances and to track multiple command inputs.

This study will analyze the practical problems involved in the real-time implementation of disturbance-rejection and tracking control policies using a digital computer. A computer simulation of the digital real-time controllers will be applied to various airborne systems in a simulation. The simulation will cover the control of airborne systems and aircraft in a number of representative flight modes. The results of the simulation studies may result in the emergence of new control performance criteria.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, DEVELOPMENT OF DRONE/REMOTELY PILOTED VEHICLE AIR CUSHION LANDING SYSTEM (ACLS) CONTRACT SUPPORT OF GROUND TEST
A. LLOYD, Boeing Company, *Seattle, Washington* 98108 (DF134890; F33615-75-C-3088)

Present parachute and midair retrieval methods for drones and remotely piloted vehicles (RPVS) incur high operating costs, restrict sortie rates and limit operational flexibility and mobility. The objective of this work unit is to provide technical support of the exploratory development, ground testing of Air Force Flight Dynamics Laboratory-developed air cushion takeoff system (ACTS), and air cushion recovery system (ACRS) on an Australian Jindivik drone aircraft. The successful development of ACTS and ACRS for these aircraft will enable reductions of 90 percent for recovery cost and 80 percent for turnaround time. In addition, a new dimension will be provided for drone/RPV deployment flexibility and mobility.

The contractor will observe and evaluate and provide the AFFDL with consultation and assistance in the planning of laboratory and ground testing of the ACTS and ACRS on the Jindivik drone. Special technical evaluations and analyses will be accomplished including a directional control study, flow control design, and ground test analysis. Individual reports shall be prepared for each major technical item and for the final evaluation of Jindivik ACTS and ACRS testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, FILTERED ESB COVERGLASS DEVELOPMENT
P. ILES, Optical Coating Lab. Inc., *Santa Rosa, California* 95403 (DF461550; F33615-77-C-2035)

The objectives of this program are to fabricate and evaluate improved designs of solar cell coverglass/filter configurations for enhanced cell array survivability to natural and military satellite environments.

Design, fabricate, and evaluate improved filtered/ESB 7070 coverglass-cell configurations. Conduct optical tests and thermal environmental tests to verify filter and ESB integrity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

2.0002, HIGH-ALTITUDE, SUPERPRESSURED POWERED AEROSTAT (HASPA)
S.H. SCALES, Martin Marietta Corporation, *Denver, Colorado* 80201 (DN585253; N60921-75-C-0150)

Design, fabricate and participate in the test and evaluation of a high-altitude, superpressured aerostat. This work unit summary supports agency accession no. DN485034.

The contract is in five phases - design concept, design, fabrication, unpowered, and powered flights, and provides for the design and fabrication of the aerostat hull and hardware, autopilot, on-board instrumentation, and system and flight-test support.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Surface Weapons Center

2.0003, SILVER HYDROGEN ENERGY STORAGE
G. HOLLECK, E I C Incorporated, *Cambridge, Massachusetts* 02139 (DF459510; F33615-76-C-2093)

To determine the feasibility and develop design data for a 35 watt-hour/pound silver-hydrogen cell capable of 500 deep discharge cycles and 1 year life in satellite applications.

The primary effort is an experimental screening of cell components, cell component arrangements, and operating parameters in a number of versatile, small-capacity, boilerplate test cells. Secondary efforts involve development of a design concept and computer model of a cylindrical cell configuration, and design, fabrication, acceptance test and delivery of lightweight full-size cells of stacked disc and possibly cylindrical designs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

2.0004, LITHIUM-INORGANIC ELECTROLYTE BATTERY INVESTIGATION
D. CHUA, Honeywell Incorporated, *Montgomeryville, Pennsylvania* 18936 (DF457310; F33615-74-C-2071)

The objective of this effort is to determine the performance capability of lithium inorganic oxychloride battery system toward certain goals.

This is a 19 month effort consisting of three tasks directed at each of the three classes of applications. Task 1 - life support, Task 2 - spacecraft 'a', and Task 3 - spacecraft 'b'.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, STRUCTURE AND PROPERTIES OF GLASSES
J.D. MACKENZIE, Univ. of California, School of Engin. & Appl. Sci., *Los Angeles, California* 90024 (DF039960; AF-AFOSR-2764-75)

AF function - advanced aircraft and tactical missile systems employ glass as a structural and optical component which requires superior mechanical, thermal and optical performance under extreme environmental conditions. Deficiency - the predictive property methodology which is essential for the design of new glass compositions with tailored properties is not well understood. Objective - this research is to establish the fundamental structure-property relationships for optimizing thermal expansion, mechanical strength and hardness, chemical durability, and interactions with infrared and visible radiation in glass. How work contributes - this research is expected to provide concepts and practical compositions for glasses which will meet aircraft windshield and infrared dome performance and laser-resistant materials requirements.

Glass chemistry will center on (1) the understanding of how glass composition and structure control thermal expansion, (2) the mechanism of ion-exchange strengthening of glass under pressure and the effects of surface structure, and (3) determination of the effects of structure and chemical composition on optical properties, particularly infrared absorption and reflection in fluoride glasses and glass-ceramics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0002, HIGH-TEMPERATURE OXIDATION AND MECHANICAL PROPERTIES OF SILICON NITRIDE
D.D. CUBICCIOTTI, S R I International, *Menlo Park, California* 94025 (DF044600; F44620-76-C-0116)

AF function - ceramic turbine engines for remotely piloted vehicles (RPV) and auxiliary power units (APU) are being developed by the Air Force, Army, Navy and NASA. Deficiency - there is a deficiency in the present knowledge of the response of these materials to degradation in hostile turbine environment over extended time periods. Short time exposure experiments look encouraging; however, there is a need for careful study into the degradation of mechanical properties as a result of chemical attack in turbine atmospheres. Objective - this research seeks to establish fundamental understanding of the chemical and mechanical behavior of hot-pressed silicon nitride in load-bearing turbine environments. How work contributes - this important data is required in order to establish the design allowables for ceramic turbine engine development.

Slow crack growth, creep and tensile fracture of hot-pressed silicon nitride will be determined. The relationship of corrosion and chemical diffusion to mechanical properties will be determined. Mass analysis of the gaseous products will be determined as well as the total weight gained during oxidation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0003, SURFACE STATES ASSOCIATED WITH CHEMISORBED SPECIES 12925-C
S.R. MORRISON, S R I International, *Menlo Park, California* 94025 (DA0G5576; DAAG29 75 C 0017)

To follow the adsorption and interaction of various gases with active centers at a solid surface. It is also planned to initiate investigations on the interactions of various species from the liquid phase with active centers at a solid surface. Results from this research have potential value for the control or enhancement of surface reactions such as corrosion, photolysis, and catalysis. Specific applications include the development of sensing for gases, selection of materials, and the enhancement of integrated circuit technology.

Interactions will be monitored by observing the resulting changes in the electrical properties of semiconducting supports. Theoretical techniques will be used to describe the system and analyze the interactions.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0004, LOW-SPEED IMPACT DAMAGE ON COMPOSITE MATERIALS
W.G. KNAUSS, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (NSG 1483)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0005, CHEMICAL REACTIONS IN TURBULENT MIXING
H.W. LIEPMANN, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (DF042810; F44620-76-C-0046)

AF function - weaponry, air-breathing propulsion, aerospace vehicles. Deficiency - with the present state-of-the-art it is not possible to predict, a priori and with any confidence, the progress of a reaction in turbulent flow. This lack of understanding of reactions in turbulent flow makes it difficult to optimize the design of the reaction sections of gas lasers and turbine engines and thus increase the system efficiency. Objective - to accelerate the acquisition of the needed understanding of this turbulent chemical reaction problem. How work contributes - increased understanding of the interaction of energetic chemical reactions and turbulent gas flows will assist practical design of combustion components of a number of devices.

In this effort a team of the country's best experimentalists in turbulent fluid flow and a top flight theoretician will explore the consequences of a new physical picture of the turbulent flow process deriving from the work of the principal investigator and his associates which revealed an organized eddy motion in turbulent shear layers. Experimental parameters to be varied will cover a wide range of values between chemical reaction time, the large-scale eddy lifetime, and the Kolmogorov microscale.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0006, THE CHEMISTRY OF XENON DIFLUORIDE (XEF2)
S.A. SHACKELFORD, U.S. Air Force, Frank J. Seiler Res. Lab., *Colorado Springs, Colorado* 80840 (DF281590)

AF function - rocket propulsion, weapons, conventional, high explosives, lasers. Deficiency - existing technology is inadequate to support future AF needs for energetic fluorine containing binders and plasticizers and for solid fuel fluorine generators. Research - the chemistry and reaction mechanisms of XeF2. How research contributes -xenon difluoride is a potentially useful reagent for effecting fluorination of energetic materials to give heretofore difficultly attainable or unattainable energetic binders and plasticizers. It is also potentially useful as a solid source of fluorine atoms for laser applications. Abstract - the reactions of XeF2 with organic substrates will be investigated. These include olefins, acetylenes, carbonyl functions, organic radicals and other organic nucleophiles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

3.0007, ELECTROCHEMISTRY OF SOLUTES IN CHLOROALUMINATE SYSTEMS
E. BERNSTEIN, Colorado State University, School of Natural Sciences, *Fort Collins, Colorado* 80523 (DF043300; AF-AFOSR-2978-76)

AF function - communications and flight operations depend on auxiliary battery sources for power. Deficiency - lighter weight, higher temperature, longer life, and higher energy batteries are needed to meet the requirements. Objective - this research involves an understanding of the solution processes by which solute materials interact with certain acid solvents. These solvents are promising as battery fluids, and as systems for metallurgical separations. How work contributes - research results have the potential of improvement in high energy density batteries, corrosion prevention, new approaches for thermal batteries, and innovations for auxiliary power sources.

Electrochemical studies are to be carried out on a variety of solute species in aluminum halide based melts, mainly low-temperature systems. The behavior and kinetics of oxygen, sulfur, selenium, and tellurium electrode processes will be studied. Aluminum oxychloride detection in the melt warrants a systematic investigation. Tungsten oxide, molybdenum oxide, and other oxides which appear stable and soluble in the melt, and of potential interest as cathode materials, will be examined. In attempting to identify certain chemical species in conjunction with the electrochemical studies, there will be an increase in spectroscopic work.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0008, BONDING AND ELECTRONIC STRUCTURE
B.M. KLEIN, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN480159)

Using the results of first-principles electronic structure calculations: 1) study theoretically the properties of existing materials to obtain a unified picture of the relationship between these properties and the chemical bonding; 2) from the knowledge gained, attempt to predict compositions and perfection of materials with enhanced desirable properties.

The basic tool for calculating the electronic structure is the augmented plane wave method. The output of these calculations, electronic energies and wave functions, are used with the appropriate theory and computer codes to calculate the properties of interest.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0009, MATERIAL SUPPORT TECHNOLOGY - OPTICAL, ELECTRICAL, & MECHANICAL PROPERTIES OF DEVICE MATERIALS FOR NAVY SYSTEMS
H.B. ROSENSTOCK, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN620095)

The objective of this work is to carry out the underlying theory and experiments concerning materials of interest to the Navy. Emphasis is currently placed on the optical properties of materials which may be employed in high-power laser optics, fiber optics, and other electro-optic materials, but other applications are also studied as they arise.

The mid-long and long-term Navy material needs are periodically assessed and research is undertaken to fulfill those needs deemed most critical and for which investigation seems most likely to result in solution of these needs. This generally involves both theory and experiments concerned with analysis of the first principles underlying the problem.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0010, STUDY OF INTERMETALLIC COMPOUNDS
J. MILLER, United Technologies Corp., *West Palm Beach, Florida* 33402 (DF680850; F33615-75-C-1166)

The objective of this program is to determine the suitability and potential of titanium aluminum (TiAl) base materials for use in aircraft turbine engines. It is of specific importance to study the response of this material, as an example of a class of materials, to the stresses, strains, and environment found in a gas turbine engine.

The program shall consist of the selection, preparation, processing, and characterization of a suitable composition based on the intermetallic compound TiAl. At the same time the manufacturing process steps necessary to produce turbine blades shall be explored and assessed. If it is determined that the necessary techniques are available, a partial set of turbine blades may be fabricated using an existing design. These blades shall be bench- and rig-tested and, if suitable, may be made available for later engine testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Materials Lab.

3.0011, HOT CORROSION AND THE EFFECTS OF NACL AND CARBON

F.S. PETTIT, United Technologies Corp., *West Palm Beach, Florida* 33402 (DF044380; F44620-76-C-0123)

AF function - the useful lives of nickel-and-cobalt-base alloys and coatings in gas turbine engines are significantly reduced under conditions where salts are ingested into the engine or are present as fuel contaminants. Deficiency - although significant progress has been made of inhibitors in fuel and maintenance washing procedures, no general theory of the initiation stages of hot corrosion exists. Objective - this research seeks to reduce the hot corrosion problem through a thorough understanding of the initiation stage and the effects produced by NaCl and carbon deposition. How work contributes - having a knowledge of the factors which initiate the reactions will enable the rational design of turbine alloys to be made.

Typical turbine alloy and overlay coatings will be heated isothermally or cyclically at 1,000 degrees C with and without contaminants. Microstructure, chemistry and structure will be examined to elucidate the initiation mechanisms of sulfidation or acidic fluxing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0012, SOLID PROPELLANT FIRE ENV STUDY

E.W. PRICE, Georgia Inst. of Technology, School of Aerospace Engin., *Atlanta, Georgia* 30332 (DF186760; F29601-76-C-0119)

The objective of this effort is to generate techniques, and/or equipment to measure controlling reactions, measure heat transfer properties, and sample hot gases of the combustion zone of burning UTP 3001 solid propellant.

In-depth literature surveys of potential experimental techniques will be evaluated, particular emphasis will be placed on adapting techniques from other fields (reentry testing) dealing with high-temperature environments. On-line mass spectroscopic techniques will be studied for potential combustion zone component analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

3.0013, WEAPONRY - COMBUSTION OF NONALUMINIZED HETEROGENEOUS SOLID PROPELLANTS

W.C. STRAHLE, Georgia Inst. of Technology, School of Aerospace Engin., *Atlanta, Georgia* 30332 (DN223680; N00014-75-C-0332)

The objective of this work is to obtain quantitative understanding of the combustion of ammonium perchlorate-binder-ammonium perchlorate (AP) sandwich models in an effort to establish a predictive capability for the burn rate behavior of composite propellants. The research, hopefully, will contribute fundamental kinetic data on binder and oxidizer decomposition; and gas-phase, catalytic, and interface reactions all pertinent to cost reduction aspects of propellant formulation and development for Navy missiles.

The investigation is aimed at acquisition of experimental data relevant to combustion of AP-binder sandwiches incorporating catalysts within the binder, oxidizer, or at the interface and extension of an analytical model to include several effects of importance. A combustion bomb, with burning up to 3,200 psi, will be utilized with deflagration characteristics inferred through cinephotomicrography and quenched sample photomicrography.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0014, EXPERIMENTAL AND THEORETICAL STUDIES OF INTRAMOLECULAR AND INTERMOLECULAR DYNAMICS

S.A. RICE, Univ. of Chicago, Graduate School, *Chicago, Illinois* 60637 (DF045720; F49620-76-C-0017)

AF function - reconnaissance, surveillance, communication and other areas required developments in new, stable lasers. Deficiency - there is a requirement for an understanding and design of systems with selective reactivity and/or energy exchange. Objectives - investigate aspects of the dynamics of intramolecular and intermolecular energy transfer and related phenomena. Provide both experimental information and theoretical descriptions which will elucidate - (1) primary processes in unimolecular reactions, (2) the pathways of energy transfer in bimolecular encounters and the relationships of these with physical processes, such as quenching of excitation, and chemical reactions, (3) the nature of the reaction products and the energy disposal between them for given initial states of the reactants. How work contributes -unravelling of the many molecular processes which underlie these phenomena will contribute to the store of concepts and information needed for upper atmosphere chemistry and physics, potential chemical lasers and the generation of chemical intermediates in defined states of excitation.

(1) Determine the rate of intramolecular vibrational relaxation and the pathways for decay of vibrational excitation in the absence of collisions, (2) determine whether intramolecular vibrational relaxation is fast or slow relative to chemical reactions, (3) determine the nature of intramolecular vibrational energy transfer induced by collisions, (4) determine the influence of initial state selection and coupling between various degrees of freedom on the course and rate of unimolecular reactions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0015, DEVELOPMENT OF THE THEORY OF REFLECTANCE AND EMITTANCE OF FIBROUS MATERIALS 14076

J.R. ARONSON, Arthur D. Little Incorporated, *Cambridge, Massachusetts* 02142 (DA0F8932; DAAG29 77 C 0011)

To develop the theory of reflectance or emittance of particulate materials so as to apply it to fibrous materials. Relevance - the research is relevant to the Army's interest in the areas of laser hardening, camouflage, and thermal insulation.

Specifically, research efforts will be concerned with obtaining the optical constants of model materials, constructing a theoretical model of the reflectance or emittance of fibers and making experimental measurements of the infrared emittance to verify and modify the developing theory.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0016, MICROWAVE PROPERTIES FOR CHARACTERIZATION AND EVALUATION OF MATERIALS

T.V. HYNES, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4721)

(1) Fiber-plastic composite materials such as carbon/boron fiber filled resins and laminated fiberglasses are important as lightweight/high-strength structural materials. Develop microwave quality assurance method of detecting voids, cracks, lack of bonding and measuring uniformity of fiber distribution. (2) Metal surfaces integrity is important in terms of corrosion resistance and strength. Develop microwave measurement method sensitive to the presence of cracks and non-uniformities.

Determination of reflection and transmission properties in the microwave region. Measure the dielectric susceptibilities and conductivities throughout the microwave region for bulk materials and surface characteristics when appropriate. Determine the microwave 'signature' with respect to flaw type, size, orientation, concentration and distribution. Primary emphasis will be given to types of test information useful for quality assurance on production lines.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0017, EXPLORATION OF SULFIDATION AS A DEGRADATION MODE FOR SILICON NITRIDE IN GAS TURBINE ENVIRONMENTS

M. LEVY, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4804)

To explore the possible degradation of silicon nitride by sodium sulfate induced accelerated oxidation (hot corrosion or sulfidation) and to assess the applicability of the failure mode involving the transformation of cristobalite to tridymite in the presence of the oxide pair Na2O-SiO2 at temperatures above 1,800 F.

Hot-pressed, reaction-sintered, and coated porous silicon nitride specimens will be coated with a layer of Na2SO4 and exposed to flowing air at temperatures between 1,800 and 2,500 F to obtain kinetic data under both isothermal and cyclic heating conditions. Baseline data will be established for silicon nitride without the Na2SO4 layer. Substantiative tests will be carried out in the Metals Research Division dynamic hot corrosion test rig which simulates actual gas turbine operation including NaCl ingestion and subsequent Na2SO4 formation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0018, CONTOURED TRANSPARENT ARMOR FOR ARMY HELICOPTERS

G.R. PARSONS, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4777; TO BE DETERMINED)

This is a contractural effort with Goodyear Aerospace Corporation (GAC) to demonstrate new technology and materials for fabricating contoured glass-plastic helicopter transparencies. Four sets of UH-1 windshields will be fabricated and environmentally evaluated, two sets will be submitted to a U. S. Army aviation test facility for flight-test evaluation.

The program is divided into two phases. The first phase includes the fabrication of four shipsets of full-size UH-1 windshields by utilizing a newly-developed interlayer material, revised processing, and an improved glass bending technique capable of improved part-to-part contour. These windshields will be subjected to a series of optical and environmental tests. In the second phase, two sets of windshields are to be installed in a UH-1 aircraft for flight-test evaluation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0019, FATIGUE CRACK PROPAGATION IN TITANIUM ALLOYS

D.A. KOSS, Michigan Technological Univ., School of Engineering, *Houghton, Michigan* 49931 (DF037650; AF-AFOSR-2596-74)

AF function - the longevity, reliability and safety of aerospace structures are related to the fatigue properties of the structural materials used. In fact, the fatigue properties of structural materials often limit their application. Opportunity - it is important to understand the mechanisms of fatigue and especially the metallurgical means by which fatigue resistance may be improved. Objective - this research will examine the criterion for stage I fatigue crack propagation (that which occurs initially along crystallographic slip planes) and determine the effect of materials parameters on these criteria in beta and alpha-beta titanium alloys. How work contributes -by better understanding of the influence of metallurgical parameters on fatigue crack propagation, guidelines for better fatigue resistance of structural alloys may be established.

In addition to obtaining the relationship between crack propagation rates, applied stress, and crack length, this study will explore the effects of environment, grain size, texture, slip character, and stress-strain behavior on stage I crack growth.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0020, DRY SILVER CAMERA FILM AEI/20

R. BROOS, Minnesota Mining & Manuf. Co., *St. Paul, Minnesota* 55119 (DF097220; F33615-74-C-1081)

Conduct exploratory research to prove the technical feasibility of formulating and coating dry silver films with the sensitometric and image definition characteristics suitable for use for TAC recon recording photographic requirements. Ultimate goals will be AEI equals 80, panchromatic sensitivity, gamma response from 1.0 to 1.6, resolution of at least 200 cycles/mm medium contrast, and processing to stable visable images using only heat. Keep silver content to the minimum required to produce the desired photographic characteristics.

Conduct exploratory research leading to the ultimate formulation and coating of experimental laboratory coated samples of dry silver films with the desired characteristics. Conduct detailed laboratory analysis of the photometric and radiometric sensitometric response of these materials. Conduct lab analysis of the image definition characteristics of thse materials. Conduct lab analysis of the variations of thermal processing on the sensitometric response characteristics, and image permanence characteristics of these materials. Conduct lab analysis of the shelf-life characteristics of these materials. Coat samples of five in wide by 250 ft rolls of films for aerial flight test evaluation of the performance of these materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

3.0021, MOLECULAR ENERGY TRANSFER STUDIES

H.K. SHIN, Univ. of Nevada System, School of Arts & Sciences, *Reno, Nevada* 89507 (DF046280; AF-AFOSR-3163-77)

AF function - surveillance, detection, communication, weaponry. Deficiency - performance calculations of chemical lasers depend on accurate kinetic information on pumping and relaxation processes. Presently, relaxation processes in HF and DF chemical lasers are not known to sufficient accuracy. Objective - investigate vibrational energy transfer in molecules and molecular ions undergoing inelastic collisions with other particles with or without involving chemical reactions. How work contributes - calculation of molecular energy transfer as a function of temperature will result in rate constants for these processes which are of value in chemical laser modeling.

The rotational model and the nonrigid dimer model will be employed to study collision processes characteristic of chemical lasers involving hydrogen fluorides and carbon dioxide. The primary concern of the theoretical calculations will be in V-V, V-R, V-T, and V-E energy transfer processes in gas lasers. In V-V processes both intra- and intermolecular processes will be investigated. The molecular energy transfer rates will be established as a function of temperature.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0022, PROCESSING MECHANISMS, STRUCTURE, AND MORPHOLOGY OF HIGH-TEMPERATURE POLYMERIC ALLOYS

I.L. HAY, Celanese Corporation of Amer., *Summit, New Jersey* 07901 (DF047260; F49620-77-C-0046)

AF function - advanced Air Force lightweight aircraft, missile and satellite systems will utilize structural matrices and adhesives which will provide high performance at elevated temperatures in extreme service environments. Deficiency - the most stable polymer systems are relatively intractable and difficult to process by current fabrication techniques. Objective - the principles and mechanisms underlying the alloying of intractable, high-temperature polymers will be investigated. How work contributes - it is expected that this research will yield combinations of polymers that are more readily fabricable and have high-temperature properties similar to the major intractable components.

Research will center on (1) the processibility of intractable polymers when alloyed with compatible polymers and monomers, (2) correlation of the particulate form and character of polymer mixtures before hot-pressing with physical and mechanical properties after consolidation, and (3) the assessment and utilization of various experimental techniques to characterize the chemical and physical interactions occurring during processing and to establish the chemical nature of the polymer alloys.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0023, LUBRICITY PROPERTIES OF HIGH-TEMPERATURE JET FUEL

L. GRABEL, U.S. Navy, Air Propulsion Test Center, *Trenton, New Jersey* 08641 (DN596808)

To determine the effects of fuel variables or components on friction, wear and seizure of pumps and to define ways of improving fuel lubricity. The fuel variables include viscosity, hydrocarbon type, trace elements such as nitrogen, sulfur, and oxygen bearing compounds, and additives.

Determine the effect of fuel variables on the lubricity of JP-5 fuels. Use a lubricity tester to obtain baseline data on the lubricity of JP-5 fuels, then establish the effects of varying concentrations of fuel additives and naturally occurring fuel components and impurities individually and/or in combination. Utilize this data to develop lubricity additive(s) that could be used in JP-5 when required.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

3.0024, DETERMINATION OF PHYSICAL AND CHEMICAL STATES OF LUBRICANTS IN CONCENTRATED CONTACTS USING INFRARED FOURIER TRANSFORM SPECTROSCOPY

J.A. LAVER, Rensselaer Polytechnic Inst., Graduate School, *Troy, New York* 12181 (NSG 3170)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0025, THICKNESS PROPERTIES OF LAMINATED FIBER COMPOSITES 13683-R-MS

A.A. FAHMY, Univ. of North Carolina, School of Engineering, *Raleigh, North Carolina* 27607 (DA0V5579; DAAG29 76 G0106)

To study the thickness properties of laminated hybrid and thick composite materials and to generate design data and a stress analysis for these materials. The hybrid composites are being considered for Army applications, such as helicopter components, disposable rocket launch tubes, armor, and rotor shafts for aircraft. The understanding of the thickness properties of the individual fibrous reinforcements and their influence on the elastic and failure properties of hybrid composites is not now sufficient to allow optimum utilization of these materials.

Prepare composite specimens of graphite-epoxy, Kevlar-epoxy, and glass-epoxy systems having various orientations of the laminates, determine the mechanical properties of the specimens, for example, Young's modulus, Poisson's ratio, tensile and compressive strength in the thickness direction, and the interlaminar shear strength, and develop a stress analysis for these materials in the form of a filament wound tube under internal pressure.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0026, GRAIN BOUNDARY AND DISLOCATION EFFECTS IN NON-OXIDE CERAMICS

A.H. HEUER, Case Western Reserve Univ., School of Engineering, *Cleveland, Ohio* 44106 (DF040300; AF-AFOSR-2789-75)

AF function - small, economical ceramic turbine engines are being developed for the propulsion of Air Force vehicles, RPV's for example. Opportunity - silicon carbide and silicon nitride type ceramics, formed by sintering or hot-pressing powders at high temperatures, will provide strong vanes and blades for such turbines. Densification aids and subsequent high-temperature creep of these materials are based upon empirical trial and error. Objective - this research program will investigate the mechanism of deformation, creep and sintering in silicon carbide, silicon nitride and other ceramics. How work contributes -understanding the mechanism will allow a rational approach to be taken in the selection of chemical composition and processing technique.

The grain boundary energetics will be studied by measuring the dihedral angles at grain boundary-pore intersections using transmission electron microscopy (TEM). TEM will also be used to examine the grain boundary phases, crystallographic phase transformations and dislocation effects in non-oxide ceramics. These microscopic observations will be correlated with manufacturing methods and high-temperature mechanical properties.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0027, EXPENDABLE GASIFIER

H. DUE, Teledyne Industries Inc., *Toledo, Ohio* 43697 (DF459100; F33615-76-C-2055)

Complete the design of an expendable gasifier which is applicable as the core of either a 230-HP jet fuel starter, a 230-pound thrust turbojet, or a 500-pound thrust turbofan engine for a remotely piloted vehicle.

Modify the existing design to obtain an optimum configuration, fabricate and extensively test the optimum configuration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0028, CERAMIC TRIBOLOGY - SILICON NITRIDE

H. DALAL, S K F Industries Incorporated, *Norristown, Pennsylvania* 19406 (DN590201; N00019-76-C-0684)

To determine parameters such as surface distress, lubrication requirements, friction and wear behavior, etc., needed for the design of silicon nitride elements as future aircraft turbine engine bearings.

This phase aims to investigate basic powder processing technology for the manufacture of silicon nitride ball blanks and to evaluate non-destructive testing methods for defects in such materials.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0029, MOLECULAR BEAM PHOTOCHEMISTRY

R.E. SMALLEY, Rice University, Graduate School, *Houston, Texas* 77001 (9989-AC5)

Research into the fundamental aspects of photochemistry has traditionally been hampered by (among other problems) an inability to (1) determine the exact nature of the excited state initially produced by light absorption, (2) determine the evolution of these photoactive states in the absence of collisions, and (3) determine the nature, internal excitation, and yield of photofragments which may be the end result of optical excitation. With such problems in mind, it is herein proposed that a supersonic molecular beam provides a remarkably ideal medium in which to study elementary photochemical processes.

The cooling achieved in a supersonic free expansion can be made so extreme that virtually all polyatomic molecules present in the expanding gas are in the lowest available rotational and vibrational quantum state. High-resolution laser excitation studies of such ultracold, unperturbed molecules can provide a dramatic increase in our understanding of the excited state structure, time evolution, and ultimate photochemical fate of a wide variety of fascinating polyatomic molecules.

Vitally important in this work are methods which can detect with appreciable quantum yield nonluminescent metastables and photofragments produced by laser excitation of the cold beam molecules. The simple open design and high efficiency of the time-of-flight mass spectrometer suit it well to this task. Mass spectrometry and a variety of other detection techniques combine with high-resolution lasers and supersonic beam technology to form a powerful new tool for the study of light-induced molecular transformations and reactions.

SUPPORTED BY American Chemical Society

3.0030, PICOSECOND RADIATIONLESS TRANSITIONS IN POLYATOMIC MOLECULES 14470-C

G.W. ROBINSON, Texas Tech University, Graduate School, *Lubbock, Texas* 79409 (DA0E9226; DAAG29 77 G0028)

To achieve a better understanding of the radiationless decay of molecules. Relevance - the proposed research is 'highly relevant to the task of the Natick Laboratories to provide personal

camouflage for the security of the individual and to investigate any threats to this security. Furthermore, a better understanding of the radiationless decay of molecules should find applications in the design of lasers and in the photochemical degradation of Army materiel.

Attempts will be made (1) to learn experimentally more about the concentration of energy into extremely short, intense bursts of light, with the idea that such knowledge will lead to better design of chemical laser systems and other sources of high peak-power energy; (2) to understand theoretically the processes responsible for the loss or utilization of energy by molecules in extremely short times; (3) to test out these theoretical ideas experimentally; and (4) to study certain photochemical transformations on these short time scales.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0031, NUCLEAR MAGNETIC RESONANCE AND ACOUSTIC NUCLEAR RESONANCE FOR NONDESTRUCTIVE EVALUATION OF STRUCTURAL MATERIALS

G.A. MATZKANIN, Southwest Research Institute, *San Antonio, Texas* 78228 (DF044200; F44620-76-C-0114)

AF function - the nondestructive evaluation (NDE) of aircraft structural materials plays an important role in safety and cost-effective use of the fleet. Deficiency - there is a deficiency in techniques for determining the residual stress and strains introduced into materials during fabrication or subsequent use. Such stresses play important roles in fatigue damage processes, stress corrosion cracking, and hydrogen embrittlement. Objective - this research seeks to apply nuclear magnetic resonance (NMR) and acoustic nuclear resonance (ANR) techniques to NDE problems of practical interest to the Air Force. How work contributes - the specific features of NMR and ANR will be defined and developed for the quantitative characterization of internal strain and stress in nonferromagnetic structural materials, such as Al, Ti, composites, and nonmetallics.

Inductive NMR signals will be detected from specimens external to both the detecting coil and the magnetic gap by utilizing a pancake-shaped detection coil placed near the surface of the specimen, with the applied field produced by u-shaped magnets. Continuous and pulsed ANR techniques will be developed for polycrystalline materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0032, ENERGY CONVERSION - LASER RAMAN SPECTRAL ANALYSIS OF ELECTRODE/ELECTROLYTE INTERFACES

P.L. HENDRA, Univ. of Southampton, *Southampton, England, United Kingdom* (DN475328; N00014-74-C-0270)

The objective of this research is to investigate the chemistry and physics of the electrocatalytic interface as it relates to the art of choosing, predicting, modifying and optimizing specific tasks of catalysts related to DOD interests. Navy applications include utilizing hydrocarbon fuels in fuel cells for power sources, developing techniques to passify metals in reducing fouling and corrosion of internal and external surfaces exposed to sea water, and the electrolytic generation of oxygen for life support systems.

This is a Raman spectral investigation of metal electrode/aqueous electrolyte and dry catalyst surfaces including, but not restricted to: the kinetics of layer formation on electrode surface (Ag, Cu, Pd, Pt, Ni, Cr, graphite, carbon black); molecular characterization of surface layers; catalytic behavior of surfaces with respect to several organics (pyridine, formates, hydrocarbons). The investigators will also devise instrumental methods for recording spectra of surfaces with very low temperatures and low coverage.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0033, CHEMICAL INITIATION OF FAE CLOUDS

G. VONELBE, Atlantic Research Corporation, *Alexandria, Virginia* 22314 (DF048960; F49620-77-C-0097)

AF function - advanced chemical explosive weapons, weapon delivery and defense, close-air support. Deficiency - insufficient understanding of basic chemical kinetic and gas dynamic processes associated with chemical initiation and transition to detonation in unconfined fuel-air clouds, lack of realistic guidelines for predicting detonation initiation, properties, scaling laws and blast potentials, and of data for evaluating feasibility of chemically initiated (single event) FAE III concept. Objective - to obtain better understanding and realistically model basic mechanisms responsible for chemical initiation and subsequent transition and propagation of unconfined fuel-air explosions and non-ideal blast waves. How work contributes - will provide (1) additional understanding of fundamental processes associated with chemical initiation of detonations and transition from deflagration to detonation, (2) quantitative models not now available for a priori predicting properties and blast initiation requirements of unconfined fuel-air explosions, their scaling laws and blast damage potential of FAE clouds, (3) data to aid in evaluating feasibility of chemical initiated detonation concept for application to advanced (single event-FAE III) explosive devices.

This research responds to RO 6.2 and encompasses experimental and analytical modeling studies of mechanisms of detonation initiation, transition and propagation in chemically sensitized unconfined fuel-air mixtures. Experiments will be carried out in a test bomb (10 liters) in which unconfined explosions of substantial scale in fuel-air mixtures can be made. Liquid and gaseous fluorinated agents (e.g., bromine trifluoride) will be dispersed into the liquid and gaseous fuel-air clouds, and their effects on achieving detonation initiation will be determined. Parameters studied will include fuel-air stoichiometry, fuel type, agent injection rate and quantity, agent dispersal pattern, droplet size, and type of fluorinated agent. High-speed photographs and pressure measurements will be obtained. Analytical modeling of the process will consider chemical kinetic and gas dynamic aspects of initiation of detonation in sensitized clouds. Requirements for initiator source strength in terms of pressure and Mach number as a function of cloud sensitization will be theoretically computed, and transition requirements for deflagration to detonation will be defined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0034, SYNTHESIS AND PHYSICAL PROPERTIES OF TRANSPARENT ENGINEERING THERMOPLASTICS BLOCK COPOLYMERS 14072-C

J.E. MCGRATH, Virginia Poly. Inst. & St. U., School of Arts & Sciences, *Blacksburg, Virginia* 24061 (DA0E9199; DAAG29 76 G0312)

It is proposed to investigate ductile glassy-glassy and glassy-crystalline block copolymers. Specifically, poly(aryl ether) polycarbonate and poly(aryl ether)-poly(alkylene terephthalate) systems will be studied in detail. Relevance - these new block copolymers potentially will have excellent dynamic mechanical and high strain rate properties and resistance to solvents. They will be candidate materials for helicopter windshields and as thermoplastics for engineering materials requiring stringent performance characteristics.

The chemistry and structural features that control phase separation and morphology will be investigated through the variation of the bisphenol in the polycarbonate structure, the diol in the terephthalate, block lengths, and block regularity. The dynamic shear moduli over a wide range of temperatures and frequencies will be used in evaluating viscoelastic characteristics.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, MICROPROCESSOR IN ULTRASONIC CONTROL FUNCTIONS

UNKNOWN, Athens State College, Undergraduate School, *Athens, Alabama* 35611 (NAS 8-32834)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0002, ANALYSIS AND VERIFICATION OF ROCKET PLUME INTERACTION EFFECTS

J.H. HENDERSON, U.S. Army, Radar Technology Laboratory, *Huntsville, Alabama* 35809 (DA0F1336)

Verification that rocket plume effects on aerodynamic characteristics during flight can be determined with wind-tunnel tests through proper plume (modeling) simulation. The primary goal is improvement in the correlation between plume characteristics and their effects on longitudinal stability. This improvement is expected to lead to better design control of the variation of rocket pitching moment with Mach number (burn time) resulting in reduced wind sensitivity of free rockets.

Due to short burn times and rapidly changing conditions such as velocity, angle of attack, roll orientation, dynamic pressure, and thrust level, it is difficult to make flight measurements with defined parameters; therefore, sled tests have been chosen as a vehicle for conducting tests. In this manner conditions can be controlled to some extent. Additional wind-tunnel tests will be required to complete modeling studies.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Aeroballistics Directorate

4.0003, FINITE-ELEMENT ANALYSIS OF SUBSONIC, TRANSONIC, AND SUPERSONIC FLOWS AROUND MISSILES 13098-E

T.J. CHUNG, Univ. of Alabama, School of Science & Engin., *Huntsville, Alabama* 35807 (DA0Q5579; DAAG29 76 G0033)

To investigate the merits of finite element solutions to the subsonic, transonic and supersonic flows around various missile and airfoil geometries. Currently, MICOM has an in-house effort devoted to evaluating the application of finite element methods to transonic solutions. The finite-element method, in addition, looks promising for a broad class of problems of interest to MICOM. At AMRDL, the problem of transonic flow on the advancing rotor tip at high advance ratios, being very geometry dependent, might be particularly well suited for the finite-element approach.

To apply the finite-element theory to three sources of difficulty in modern computational fluid dynamics, i.e., complicated geometries, complicated boundary conditions and viscous effects. Axisymmetric inviscid flows, inviscid three-dimensional flows and viscous flows past axisymmetric geometries will be considered.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0004, CLUSTER VARIATION STUDY OF COHERENT ORDERING IN FCC AND BCC SOLUTIONS 14071-MS

D. DEFONTAINE, Univ. of California, School of Engin. & Appl. Sci., *Los Angeles, California* 90024 (DA0E9281; DAAG29 77 G0002)

To apply the cluster variation method to a number of heretofore intractable theoretical problems in the field of coherent order-disorder reactions in BCC and FCC lattices. The research is relevant to Army programs in alloy development, heat treatment of alloys, phase transformations in alloys. As such, the research is relevant to problems in development of a whole spectrum of new materials (e.g., clustering in the new amorphous magnetic alloys which may be employed in shielding), as well as the solution of a large number of problems with existing materials (e.g., ordering in commercial nickel-based super alloys such as hastelloy b, which are employed in aircraft engines).

The program will include (1) computation of coherent ordering phase diagrams, (2) computation of long range order parameters in the investigated alloy system as a function of temperature, and (3) computation of short range order parameters (cluster probabilities) in the investigated alloy systems and comparison with x-ray and neutron diffraction data.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0005, SEMICONDUCTOR PROPERTIES NEAR INTERFACES

D.B. WITTRY, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (DF049770; AF-AFOSR-3419-77)

AF function - microwave solid-state electronic devices are essential components of Air Force surveillance, electronic countermeasures and communications systems. Deficiency - GaAs and InP are presently the most promising materials for these solid-state devices and many devices are fabricated by growing epitaxial layers on substrates of essentially the same material. Typically, however, the impurity concentration of the epitaxy and the substrate are different and it is this interface region which is not understood. An understanding of this interface region is necessary in order to correctly predict and control the performance of devices utilizing the epi/substrate structure. Objective - the objectives of this research are to determine the concentration of impurities in GaAs or InP substrates near the substrate/epilayer interface and to investigate the electronic properties of semiconducting substrates of GaAs and InP near this interface. How work contributes - this work will contribute to a better understanding of III-V semiconductor device performance by obtaining more knowledge concerning the epilayer/substrate interface region of these devices.

The initial portions of this work will deal with GaAs and be expanded to InP at a later date. In addition to studying the GaAs (InP) -epilayer on GaAs (InP) substrate, samples of GaAs or InP without epilayers will be subjected to various heat treatments in an effort to obtain a better understanding of how the loss of one of the atomic components affects interfacial impurity concentrations. Four experimental techniques will be used in this effort to first determine the nature of the defects and impurities which are present and then understand the reasons for the presence and formation of these defects and impurities. Both sputtered ion mass spectroscopy and electron probe X-ray microanalysis will be used to determine impurity concentrations in the interface region. Room temperature scanning cathodoluminescence microscopy will be employed to determine the influence of impurity concentration variation on radiative recombination of excess carriers while low-temperature cathodoluminescence will be used to determine the energy levels of the interfacial impurities. Finally, electron beam induced currents on angle specimens will be used to indicate the presence of P-N junctions and to provide information on minority carrier diffusion lengths near the interface.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, NAVY VEHICLE DESIGN AND CONSTRUCTION - STRESS, BUCKLING AND VIBRATION OF HYBRID BODIES OF REVOLUTION

D. BUSHNELL, Lockheed Missiles & Space Co., *Palo Alto, California* 94304 (DN575070; N00014-76-C-0692)

The objective of the proposed research effort is to perform an analysis, generate a computer program, and obtain numerical results for the stress, bifurcation buckling, and modal vibration of hybrid bodies of revolution consisting of combinations of thick and thin segments and branches. These structures are characteristic of missiles, submarines, and aircraft components, all of which are of direct Navy interest. Axisymmetric large deflections elastic-plastic material properties and creep will be included. Bifurcation buckling and vibration modes can be axisymmetric or non-symmetric.

A simultaneous equation solver and eigenvalue extraction subroutines, written by Frank Brogan of Lockheed Palo Alto Research Laboratory, for the STAGSC computer program, are being incorporated into BOSOR6. Most of the effort involves modifying existing BOSOR6 subroutines and writing new ones for integrating Brogan's out-of-core solvers with the BOSOR6

system. To make BOSOR6 program capabilities conformable with the user documentation it is necessary to include body forces, imposed displacement conditions, and check out the creep capability.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0007, COMMUNICATIONS - ELECTRONIC CIRCUITS AND INFORMATION SYSTEMS-JSEP

J.D. MEINDL, Stanford University, Stanford Electronics Labs., *Palo Alto, California* 94305 (DN624275; N00014-75-C-0601)

To provide the Navy with the technological base for improved solid-state components, circuits and information handling techniques for communications, surveillance, data processing, guidance and control by taking advantage of vast expertise available at institutions of recognized standing such as this one under the Joint Services Electronics Program (JSEP). The study of electronic components and integrated circuits leads to advanced electronic systems of many kinds having advantageously high performance, high sensitivity and high component density.

State-of-the-art research undertaken include the following: two-photon resonantly pumped IR upconverters, studies of new materials using photoemission and auger electron techniques, transport properties of ternary semiconductors, bandwidth modeling in cascade charge coupled devices, electromagnetic wave propagation and blurred image processing, computer architecture, computer design limits and languages, adaptive recursive filters, data compression techniques, statistical signal processing and the measurement of lunar tidal winds in the thermosphere.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0008, ANALYTICAL AND SEMI-NUMERICAL METHODS OF FLOW CALCULATIONS

M.D. VANDYKE, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DF038360; AF-AFOSR-2649-74)

AF function - advanced aerospace vehicles. Opportunity -improvement of present semi-numerical methods used for solving viscous flow problems which are inadequate. Objective - develop and refine two semi-numerical methods concerned with flow calculations of viscous flows. How work contributes-improvement in the capability to make flow calculations for viscous flows will permit more accurate and better designs of advanced aerospace vehicles.

Efforts will be concentrated on developing and refining two semi-numerical schemes - computer extension and improvement of perturbation series, and the method of series truncation. Applications will be made to problems in viscous flow.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0009, CONTROL AND IDENTIFICATION FOR NAVAL SYSTEMS

J. TYLER, Systems Control Incorporated, *Palo Alto, California* 94306 (DN223322; N00014-72-C-0327)

The complexity of modern naval systems such as high-performance aircraft, submarines, etc., require new techniques for mathematically modelling systems and for providing accurate and reliable control for these systems. The objective of this effort is to develop methods for mathematically modelling modern Navy systems for the purpose of improved simulation, design and control.

This year the contractor will concentrate on unifying and extending the broad content of the meeting on control theory and naval applications.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0010, COMMUNICATIONS - RESEARCH ON SOLID-STATE ELECTRONIC PRINCIPLES AND DEVICES

C.A. MEAD, Calif. Inst. of Technology, School of Engineering, *Pasadena, California* 91109 (DN623757; N00014-76-C-0367)

New and faster microprogrammable microprocessors will find increased usage in naval electronic systems that are designed on a distributed function basis.

This research investigates the optimization, capable from large-scale integrated circuit technology, of new architectures for microprogrammable microprocessors. General techniques for the management of complexity and the optimal design incorporating circuit complexity are under investigation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0011, MECHANISMS OF EMITTER SURFACE DAMAGE DURING EHD COLLOID PARTICLE GENERATION AND ACCELERATION

J. PEREL, Phrasor Technology, *Pasadena, California* 91101 (DF040730; F44620-75-C-0056)

AF function - satellite surveillance, communication and navigation, advanced electric propulsion engines. Deficiency - insufficient fundamental understanding of the basic mechanisms and processes associated with colloid particle generation and acceleration and with the mechanisms of emitter tip surface damage causing performance degradation in colloid thrusters. Objective - to understand and develop accurate theoretical and mathematical models which describe the colloid beam generation and acceleration phenomena and which describe and predict emitter damage during EHD particle generation in colloid thrusters. How work contributes - will provide better understanding of the primary mechanism(s) responsible for emitter tip surface damage during EHD particle generation and acceleration, will provide realistic theoretical and analytical models describing and predicting such damage as well as the colloid beam generation and acceleration characteristics, and will contribute to establishing realistic design criteria for development of advanced colloid thrusters with improved reliability, lifetime performance and cost.

This program responds to RO 5.1 and encompasses theoretical and experimental studies of various damage mechanisms such as sputtering bombardment by negative particles, arc and spark erosion, and erosion due to cavitation, associated with emitter damage occurring during colloid thruster charged particle generation and acceleration. Corrosion due to electrochemical action of halogens in the propellant fluid and inertness of platinum under high stress conditions will also be examined as possible contributory mechanisms. A further objective of the program will be to characterize emitter damage mechanisms as thruster operative or facility induced phenomenon. Investigations will center on the electrohydrodynamic (EHD) process in determining dynamic activity occurring in the region of the propellant fluid/metal interface, including the area of damage. Theoretical models will be formulated and experimentally validated which realistically describe and predict emitter damage during ehd particle generation, define the colloid beam generating mechanisms and provide the basis for making colloid emitter material and operating environment recommendations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0012, FUNDAMENTAL COMBUSTION STUDIES RELATED TO AIR-BREATHING PROPULSION

F. WILLIAMS, Univ. of California, School of Engineering, *San Diego, California* 92038 (DF034870; AF-AFOSR-3362-77)

AF function - advanced air-breathing engines, airborne weapons delivery and defense. Deficiency - insufficient understanding of the basic mechanisms and processes involved in advanced air-breathing combustors and lack of realistic guidelines for predicting propulsion engine and external burning characteristics and combustor design with acceptable pollutant emissions. Objective - to understand and develop accurate theoretical and mathematical models describing the hydrocarbon droplet combustion and extinction, carbonaceous particle ignition and combustion phenomena in premixed and unpremixed turbulent subsonic and supersonic reactive flows. How work contributes - will provide additional understanding and realistic analytical modeling of turbulent reactive flow fields not now available and will contribute to establishing realistic design criteria for efficient, stable air-breathing combustors with in-

creased combustion efficiency and acceptable exhaust gas pollutants and reduced vehicle detectability. Also will aid design of external burning and other types of propulsion and control systems utilizing turbulent diffusion flames.

Ignition and combustion mechanisms of hydrocarbon droplets and carbon particles, and turbulent diffusion-flame combustion will be studied. High-speed photography will be used to observe individual droplet and carbon particle ignition and combustion in controlled oxygen-containing atmospheres. Pressures will range from 1/10 to 5 atm and droplet and particle diameters from 20 to 2,000 microns. Ignition will be produced by a pulsed laser and by a spark discharge. Attention will be focussed on alternate fuels (e.g., alkanes) and carbonaceous materials. The theoretical methods will be primarily analytical, but involving small-scale computer calculations. Experimental observations will guide development of burning process theoretical models. For the hydrocarbon droplets and carbon particles, emphasis will be on combustion-dynamics aspects of steady-state combustion processes, of overall finite-rate gas-phase chemistry and of extinction processes, as they affect smoke production and loss of combustion efficiency. For turbulent diffusion flames, the emphasis will be on novel ways to calculate burning rates and nitric oxide production rates.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0013, COMMUNICATIONS - BAND STRUCTURE MODIFICATIONS IN SUPERLATTICE STRUCTURES

H. KROEMER, Univ. of California, School of Engineering, *Santa Barbara, California* 93106 (DN475093; N00014-76-C-1044)

To investigate the properties of electrons in minibands formed in either superlattices or quantum size effects and their possible use in semiconductor devices for application in naval communications, computation, and signal electronics.

The effects of screening and self-energy are studied in Peirl's instabilities in periodic superlattices. Work on purely electronic modification of such instabilities is also carried out. A study of the dynamics of the motion of a Peirl's instability through its host lattice and of its high field behavior will be undertaken. A study of two-dimensional surface superlattices created by atomic steps on an off-oriented semiconductor surface will be carried out. Experimental work on negative differential conductivity in the TTF halogenides will be carried out.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0014, PERMANENT MAGNET HIGH-POWER MICROWAVE TUBES

W. HARMAN, Hughes Aircraft Company, *Torrance, California* 90509 (DF741360; F30602-77-C-0109)

The objective of this effort is to eliminate the electromagnetics required to focus linear beams operating in excess of 100 kw peak power. The Air Force is charged with the detection, identification and tracking of vehicles in the earth's atmosphere and in space for both tactical and strategic defense. This function must be achieved with the minimum life-cycle cost. The high-power transmitters in Air Force radars currently employ linear beam microwave amplifiers (klystrons, TWTS) that require external electromagnetics that are 1) costly, 2) consume prime power, 3) are heavy, 4) add to system complexity and logistical support problems.

Rare-earth magnetics such as samarium cobalt produce high magnetic fields and can now be produced at a reasonable cost. This effort will study the replacement of the electromagnets with S5Co17 to achieve a 10 to 1 weight reduction, a 5 to 1 cost reduction, and a total operating efficiency improvement.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0015, ENERGY TRANSFER AND CHEMICAL REACTIONS IMPORTANT IN MOLECULAR LASERS

G. BURNS, Univ. of Toronto, *Toronto, Ontario, Canada* (DF041390; AF-AFOSR-2856-75)

AF function - future Air Force capabilities in reconnaissance, communications and other areas require new, more efficient gas lasers operating at shorter wavelengths. Deficiency - shorter wavelength lasers, pumped by chemical reactions are essentially non-existent. Existing gas lasers do not operate at predicted power levels indicating the presence of deactivating processes. Objective - use the flash photolysis-kinetic spectroscopy technique to search for new chemical systems capable of producing efficient electronic transition lasers. Study fluorine atom, three-body recombination and the reactivity and relaxation of vibrationally excited HF using tunable dye lasers. How work contributes -provides increased understanding of gas dynamic and quantum processes which can lead to the discovery of new gas lasers.

Use the wide temperature range flash photolysis-kinetic spectroscopy apparatus to study chemical reactions which produce electronic excitation and to study the rates of fluorine atom recombination. A ruby laser and a tunable dye laser will be used to excite high vibrational levels of HF (V equals 3, 4, 5, 6) and observe their reactivity and relaxation. Trajectory calculations will be carried out for comparison with experimental data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0016, ENGINEERING TECHNICAL SUPPORT

C.B. EMMANUEL, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8G172251)

PROJECT OBJECTIVE: Specify, procure and/or design and develop, and assist in the operation of instrumentation used for environmental research primarily in Research Facilities Center (RFC) aircraft.

CURRENT YEAR PLAN: Installation of sensors aboard the aircraft continues. The RFC must update certain airborne sensors and their associated electronics with state-of-the-art, maintain all airborne systems to optimize its capabilities in support of approved programs. Some modification of a limited number of sensors is required for airborne operation.

PROGRESS REPORT: The data acquisition systems (both meteorological and radar) have been installed and checked out on all aircraft, excluding the radar system on the C-130. Several sensors have been modified, installed on the aircraft and checked out.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

4.0017, WHITE SANDS MISSILE RANGE SOUNDER

W. NEFF, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (RAA74485)

PROJECT OBJECTIVE: To construct and calibrate a microprocessor-controlled acoustic sounder. Installation to be at White Sands Missile Range.

CURRENT YEAR PLAN: Construction and calibration at Table Mountain during August-October. Installation at WSMR during December 1977.

PROGRESS REPORT: Components have been ordered.

SUPPORTED BY U.S. Dept. of Defense, Army

4.0018, FEEDBACK SYSTEM THEORY

I.M. HOROWITZ, Univ. of Colorado, School of Engin. & Appl. Sci., *Boulder, Colorado* 80302 (DF042660; AF-AFOSR-2946-76)

AF function - the design of feedback systems for Air Force turbojet system control. Deficiency - the synthesis of linear feedback system with no parameter uncertainty is a straightforward task. However the synthesis of nonlinear feedback or linear single input-output multiple-loop systems with significant parameter uncertainties in order to satisfy quantitative performance specifications is inherently difficult and no effective procedures are available for these problems. Objective - the objective of this research program is to extend the synthesis theory for systems of the nonlinear feedback class to an infinite set of system inputs. The second objective is how best to divide the feedback burden between the loops of the linear single input-output multiple-loop

system. How work contributes - success here would result in improved performance in major Air Force systems.

Research will proceed in two areas. First, synthesis theory will be used to extend previous work on nonlinear feedback systems with significant parameter uncertainty to an infinite set of system inputs. The design philosophy will be to replace the nonlinear time-invariant set by an equivalent linear time-invariant set of transfer functions and then design the resulting equivalent linear time-invariant system. Second, synthesis theory will be used on single input-output multiple loop uncertain systems (both cascaded and parallel). The research on multi-loop systems will emphasize design to provide optimum feedback distribution between the different system loops. At first no plant modification will be allowed indicating that the system has been built and now must be controlled. Secondly, plant modification will be allowed to indicate control design inherent with the plant design.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0019, RESEARCH IN MODELS COVERING MICROPROCESSOR ARRAYS FOR FINITE ELEMENT STRUCTURAL ANALYSIS
H.F. JORDAN, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (NSG 1489)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0020, A STOCHASTIC MODEL OF RADIATION INTERACTIONS WITH A SPHERICAL CELL
J.M. CUPELLO, U.S. Air Force, Chemistry & Biol. Sci. Dept., *Colorado Springs, Colorado* 80840 (DF282140)

AF function - develop an understanding of cellular mechanisms of stress reactions in habitable crew environments. Deficiency - lack of understanding of many reactions of the body to environmental stress. Objective - a two-phase study. Phase I- computer simulation of a spherical cell exposed to ionizing radiation, to include stochastic energy losses in the cell, repair of damage, and changing target volume. if successful, Phase II- continued research and refinement of Phase I analysis. How research contributes - once the cell model is constructed and tested to insure that it closely simulates the real world, the cell will be exposed to typical crew environments in an attempt to assess the basic causes of performance decrement.

A 10 micron radius spherical cell containing a nucleus will be exposed to ionizing radiation during various stages of its cell cycle, and the cause and probability of cell death determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

4.0021, TECHNICAL EVALUATION OF THE THERMAL NEUTRON EXPLOSIVE DETECTION PROGRAM
UNKNOWN, U.S. Dept. of Energy, *Washington, District of Columbia* 20545 (FA77WAI-747; FA160286 (TRAIS NO.))

Provide technical assistance and support services of Dr. Rich Howell, on an (on-call) basis, in connection with the technical evaluation of the Thermal Neutron Explosive Detection Program.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0022, UNCONVENTIONAL SURVEILLANCE TECHNOLOGY
T.A. CHUBB, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN320117)

(1) To construct demonstration surveillance and threat warning devices based on the NRL space science program technology.

The NRL Space Research program provides technological developments useful for surveillance. Promising items are developed to provide demonstration devices. Laboratory, field and flight-tests are carried out. Applications are in the areas of surface and air attack threat warning, extravisible vision, ocean surveillance from space and aircraft; missile surveillance from space.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Electronics Systems Command

4.0023, INVESTIGATION OF EXTRATERRESTRIAL RADIO RADIATION FOR NAVAL NAVIGATION, TIME DETERMINATION, SYSTEM EVALUATION
C.H. MAYER, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN620165)

Provide scientific data and technology for improvement in applications areas of precise time and position determination, navigation, communications, remote sensing, and surveillance.

Map and calibrate sources of radio radiation in space and atmosphere. Define natural background and propagation limitations to radio frequency applications. Develop and evaluate new radio interferometer techniques and applications such as precise time and position determination. Determine accurate radio source position reference system. Develop radio remote sensing techniques and applications such as stratospheric ozone determination.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0024, BASIC CATHODE STUDIES
R.E. THOMAS, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN580202)

The objective is to determine the basic mechanisms that limit the performance of thermionic and secondary emission cathodes such as are used in microwave power tubes. The results of these studies are to be used as a guide for the development of cathodes having greater emission densities and higher reliability.

Modern surface analytic technqiues, e.g., SLEEP, LEED, Auger and quadrupole mass spectroscopy. Optical absorption, low-energy electron laser spectroscopy (LEELS) photoemission and others are used to study the basic properties surfaces of state-of-the-art and prototype cathodes. These studies are designed to determine the roles played by atomic structure, chemical composition, evaporation rates, surface dipoles and electronic surface states on the thermionic and secondary emission properties of these surfaces.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0025, FLUTTER
J.E. MOORE, U.S. Air Force, Armament Laboratory, *Eglin Air Force Base, Florida* 32542 (DF626620)

To develop an in-house capability to analytically predict the flutter characteristics of winged munitions and aircraft/munition combinations. This capability should include the ability to handle subsonic and supersonic analyses using both two- and three-dimensional unsteady aerodynamics.

The techniques and procedures necessary to perform a flutter analysis of a winged vehicle have been developed and in many cases already exist in the form of computer programs. During this effort promising existing programs shall be acquired and implemented on the local CDC 6600 computer. These programs will be modified and when needed new programs written until a satisfactory flutter analysis computer program package is developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

4.0026, ANTIARMOR CLUSTER MUNITION ORIENTATION/STABILIZATION ANALYSIS
L.R. PITTS, U.S. Air Force, Armament Laboratory, *Eglin Air Force Base, Florida* 32542 (DF643090)

To qualitatively investigate by experiment the terminal stability performance of three different submunition shapes that represent possible antiarmor cluster munition (ACM) concepts. Each of the three submunition shapes will be subjected to the following: (a) comparison of predicted and actual decelerator per-

flight ranges. theoretical analysis and numerical techniques are also used.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Labs.

4.0033, TURBULENCE IN STRATIFIED SHEAR LAYERS
R.R. LONG, Johns Hopkins University, School of Engineering, *Baltimore, Maryland* 21218 (DN223076; N00014-75-C-0805)

Turbulence in the ocean interior influences parameters concerning non-acoustic detection of submarines. When fluids possess density stratification and a velocity shear, conditions exist under which internal waves form unstably, break and create turbulent regions which are not physically homogeneous with the ambient environment. Manifestations of the process, i.e., their initiation, development and role in energy dissipation within fluid, must be understood both analytically and experimentally before accurate methods of detection and avoidance can be prescribed.

The theory of turbulence and mixing processes in stratified fluids has been advanced to a stage where its application to an important geophysical problem suggests itself. The phenomena chosen is the circulation and depth of the upper mixed layer in an estuary, such as even the Baltic Sea. Only primitive theoretical analysis has developed thus far and the problem seems tractable to the methods developed by Long. The implications are non-negligible for understanding pollution, since nearby regions are frequently densely populated implying quantity of water, mixing and intensity of circulation may be insufficient to keep pollution at a tolerable level. Sufficient data exists to check the theory and also carefully designed laboratory modelling will guide necessary approximation and determination of appropriate physical parameters.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0034, COHERENT SCATTERING OF VISIBLE LIGHT INTO HIGH-FREQUENCY RADIOWAVES
J. WEBER, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (DF049540; AF-AFOSR-3399-77)

AF function - Air Force functions of surveillance, detection, and communication are susceptible to the problem of induction of radio and microwaves when laser beams impinge on radar system supports. Opportunity - successful conclusion of the project offers the possibility of ameliorating the problem. Objective - to investigate experimentally and theoretically a novel experiment in the conversion of visible light to high-frequency radio waves - the interior of a coaxial cavity filled with distilled water was illuminated by visible white light of an intensity of a few watts resulting in the increased noise output of a low-noise radar receiver (100-140 MHz) by an order of magnitude. How work contributes - identifying the properties of the conversion and clarifying the underlying theory will clarify the mechanisms of the induced radio radiations and indicate techniques for amelioration.

The observed output intensities imply new theoretical models which lead to a deeper probing of coherent vs incoherent scattering. Observations of the effect will be made as a function of the intensity, coherence, frequency, and polarization of the source and output, and for a variety of substances within the cavity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0035, BASEMOUNTED ANTENNA FLIGHT INSTRUMENTATION (BAFI)
A. SINDORIS, U.S. Army, Harry Diamond Laboratories, *Hyattsville, Maryland* 20783 (DA0F5673)

To provide the required antenna support for the BAFI flight-test program which includes the RF feed components needed for the instrumentation package.

Check out an existing basemounted antenna design that uses air-filled and foam-filled cavities. Design RF feed and reflectometers.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Harry Diamond Lab.

4.0036, THERMAL STABILITY ANALYSIS OF HIGH-POWER, HIGH-FREQUENCY SOLID-STATE DEVICES
D.H. NAVON, Univ. of Massachusetts, School of Engineering, *Amherst, Massachusetts* 01002 (ENG75-09334 A01)

This program will continue and complete the comprehensive computer-aided analysis of the electrical current and heat flow patterns in the two-dimensional model of a bipolar transistor structure. Particular attention will be paid to the device's thermal stability in high-power, high-speed switching circuit applications. This necessitates the numerical solution of the time- and temperature-dependent Poisson charge equations as well as the electron and hole current continuity equations. Emphasis will be placed on adding to the model semiconductor effects such as heavy emitter doping, Fermi statistics, surface and Auger recombination, the Franz-Keldysh effect, temperature-gradient current components, and temperature- and field-dependent minority carrier capture cross sections. The effect of electrical circuit interaction with transistor device behavior will be included. Emphasis will also be placed on optimum device design for thermally stable operation in circuits with inductive loads to avoid second breakdown.

This is a continuation of research previously conducted under NSF grant ENG-7509334.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0037, LONG-TERM LASER FREQUENCY STABILIZATION USING A MOLECULAR BEAM
S. EZEKIEL, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DF031920; F44620-76-C-0079)

AF function - this research is concerned with the long-term stabilization and resettability of a laser frequency. It is directly related to the establishment of wavelength standards and thus to improvements in long-range optical communication and in the precision of length and distance measurements. The results achieved to date have been excellent. Objective - future improvements in Air Force optical communication and rangefinding systems will require advances in laser technology. The objective of this research is to stablize the frequency of the 514.5 nanometer line of high-power (15 Watt) cw argon ion laser. Contribution - the gas laser is a stable oscillator with an intrinsically narrow spectral width which, in principle, is limited to a few parts in ten to the fifteenth by fundamental noise sources. In practice, this limit has never been reached. The major extrinsic noise sources are fluctuations in the optical length of the laser cavity due to mechanical disturbances caused by thermal and acoustic noise as well as variations in the refractive index of the laser gain medium. The scheme in this work employs an absorption line observed in a molecular beam of iodine as an absolute reference. Absorption is measured by the resonance fluorescence induced by the laser in the beam. Such a stabilized laser, aside from its clear application as a primary length standard, will find applications in laser communications and rangefinding systems.

The research program will attempt to stabilize the oscillation frequency of the 5145 A degree line of a high-power (15 watt) cw argon ion laser. The stabilization scheme employes an external Fabry-Perot as a short-term reference to reduce the laser jitter to less than 1 KHz and a resonance line in an iodine molecular beam as the long-term reference. A stability of one part in ten to the fourteenth is anticipated. The feasibility of such a stabilization scheme has already been demonstrated under previous AFOSR support. The problem of the reproducibility of the stabilized laser frequency will also be examined. A reproducibility of better than one part in ten to the thirteenth is anticipated. Experiments will also be conducted to demostrate the application of long-term stabilized high-power argon lasers in heterodyne and homodyne communication systems and in the precision measurement of position and velocity at a long distance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

formance, (b) investigation of different decelerator attachment points effects on stability, (c) examination of height-of-burst (HOB) fuzing probe length effects and probe tip plate effects on stability.

The terminal conditions experiments will be accomplished in the Air Force Flight Dynamics Laboratory twelve-foot vertical wind tunnel located at Wright-Patterson AFB, OH. The wind tunnel instrumentation and cameras will be utilized to determine the performance of the submunition shapes. The three submunition shapes will be constructed in such a manner that will allow interchange of HOB fuzing probes, probe tip plates, and decelerator attachment points. Each submunition shape will be tested with a number of different probe configurations and decelerator attach points. Several HOB fuzing probe tip plates will be investigated on one of the three submunition shapes. Total number of tests to obtain the required information should be approximately thirty.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

4.0027, QUALITY ASSURANCE PROCEDURES FOR COMPLEX MICROCIRCUITS

J. WOLCOTT, Harris Intertype Corporation, *Melbourne, Florida* (DF736640; F30602-76-C-0328)

Evaluation of existing microcircuit quality assurance procedures to determine their effectiveness for screening complex microcircuits. The establishment and implementation of more meaningful and economical screens for complex microcircuits and the evolution of effective techniques for lot conformance testing of low-volume parts will result from this work. This effort will also attempt to establish the risk associated with relaxing, eliminating or replacing certain screening requirements in complex device procurements, where complexity and technology trends make compliance even more difficult and expensive.

Existing precap visual criteria of MIL-STD-883, which have become difficult or impractical to apply on complex and multilevel metallization devices, will be evaluated to determine what criteria could be inspected by using alternate methods of test, i.e., thermal cycling, burn-in, special electrical testing or other unique screening techniques. The apparent problem with the existing visual is in metallization contact area, oxide and diffusion faults, alignment and missing or scratched conductors. It is proposed to initiate a study to cover three major areas: (1) bipolar MSI/LSI (60 gates or more), (2) MOS memories, and (3) large hybrid arrays. These efforts will investigate the effectiveness of alternate non-visual screening methods including the following either as individual or combined screens for detecting and eliminating anomalies that are normally rejected in visual inspection: (1) thermal cycling, (2) burn-in, and (3) electrical testing. The relative effectiveness of the alternative screens will be evaluated separately and in combinations and compared to the results when visual screens are applied in whatever manner is possible for complex devices.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0028, 360-DEGREE ANNULAR VISUAL SYSTEM

F.J. OHAREK, U.S. Navy, Research & Technology Division, *Orlando, Florida* 32813 (DA0P4995)

A design analysis and experimental investigation to determine the feasibility of using annular optics, and charged coupled devices (CCD's) to provide a 360-degree high-resolution visual presentation of dynamic, real-world, tactical scenes for pilot and ground vehicle crew training.

Following critical analysis and design of subsystem components, a breadboard model of a 360-degree annular pickup and display system will be built for test and evaluation. The technical approach is based upon a recently developed annular optical lens capable of taking and projecting 360-degree annular pictures. In the breadboard model, an optical probe will pick up a 360-degree annular image of a terrain model board. The annular image will be scanned onto a radial array of CCD's which will convert the annular image into video signals. The video signals will modulate laser beams in an annular laser projector which will scan the scene onto a spherical viewing screen. The breadboard visual system will be tested and evaluated for application to the AAH and ASH synthetic flight trainers.

SUPPORTED BY U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command

4.0029, VIRTUAL IMAGE DISPLAY DEVICE

G. ROSENDAHL, U.S. Navy, Physical Sciences Laboratory, *Orlando, Florida* 32813 (DA0M4995)

An efficient, lightweight, compact, low-cost virtual image display divice is needed for future flight trainers and vehicle crew trainers. This device should meet tri-service requirements with specific US Army applications in synthetic flight trainers and tank driver simulators.

The approach is to design and breadboard a system of Fresnel lenses on thin plastic plates with refractive indices suited for chromatic correction. Following appropriate testing, a specification will be prepared for future visual system procurements.

SUPPORTED BY U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command

4.0030, TRANSIENT BEHAVIOR OF RADIATION AND SCATTERING FROM CONDUCTING BODIES

P.L. USLENGHI, Univ. of Illinois, School of Engineering, *Chicago, Illinois* 60680 (DF047600; AF-AFOSR-3253-77)

AF function - wideband radar detection and EMP hardening of aerospace vehicles. Deficiency - algorithms for electromagnetic radiation and scattering under transient conditions need improvement. Objective - solutions will be sought to five problems in areas of uncertainty. How work contributes - solutions will enhance engineering understanding and thus aid design. Hopefully new design techniques may be suggested.

Solutions to the following problems in transient electromagnetic radiation and scattering will be sought and properties of interest in physical and engineering applications will be investigated. The five problems with the best understood first are transient radiation from spheroidal antennas, constraints on the singularity expansion method for early time transients, loop antennas in a dispersive environment, radiation from truncated guiding structures, and pulsed antenna array radiation pattern design techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0031, NUMERICAL SOLUTION OF THE COMPRESSIBLE BOUNDARY LAYER EQUATIONS WITH VISCOUS-INVISCID INTERACTION

R.J. BODONYI, Indiana University - Purdue U., Graduate School, *Indianapolis, Indiana* 47401 (NSG 3183)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0032, FLIGHT MECHANICS--EXPLORATORY DEVELOPMENT TESTING--AERODYNAMICS BALLISTICS TECHNOLOGY

R.H. KRIEGER, U.S. Army, Ballistic Research Labs., *Aberdeen Proving Ground, Maryland* 21005 (DA0N4426)

This project covers exploratory development tests and applied research programs in the field of aerodynamics and flight mechanics which contribute to the rational design of projectiles, missiles, shells, and rockets. Significant studies undertaken involve the measurement of supersonic and transonic magnus force on non-conical boattails--determine supersonic magnus force on low-drag ogive boattail models--probing the transonic boundary layers--obtain total head pressure surveys of the boundary layer on yawed spinning models with boattails--and to perform 3-D transonic inviscid flow calculations.

Exploratory development tests and applied research programs are conducted in closed circuit variable density, continuous flow transonic and supersonic wind tunnels as well as in free-

4.0038, EXCITED-STATE ENERGY TRANSFER PROCESSES AND CHEMICAL REACTIONS
D.E. PRICHARD, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (DF042960; AF-AFOSR-2972-76)

AF function - the Air Force is interested in the development of high-power laser technology. Deficiency - techniques are needed for obtaining more detailed information on reaction rates, cross-sections, rate constants, and mechanisms. Objective - a new technique is being developed which permits measurements of the velocity dependence of energy transfer cross-sections of specific excited states. Contribution - this technique will be applicable to measurements on potential laser species.

This research will use a tunable laser to excite molecules to a particular vibration and rotation state and also to select their velocity by means of the Doppler shift. Both the transfer and redistribution of initial translational, vibrational, and rotational energy is studied as these molecules collided with various atomic and molecular targets. This technique also allows the study of electronic orientation-dependent effects in energy transfer collisions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0039, HF SIGNAL PROC/DET ANALYSIS
V. RAJAN, Boston College, Graduate School, *Chestnut Hill, Massachusetts* 02167 (DF900880; F19628-76-C-0006)

AF function - long-range detection. Deficiency - auroral clutter severely degrades OTH-radar performance. There is insufficient knowledge on the structure of these irregularities. Research - to characterize the temporal and spatial structure of auroral irregularities responsible for clutter on high-frequency OTH radar systems. How research contributes -this effort will result in a detailed description of the structure of auroral irregularities. This information is necessary for the design and operation of OTH radar systems and will allow adaptive signal processing techniques to be developed which will improve the performance of these systems.

Use available data with specifically prepared computer programs for analyzing the Doppler and angular spectra of aurorally propagated signals. Develop programs to analyze the statistical structure of the received noise and clutter. Previously developed computer programs for automatic processing of vertical HF ionograms will be extended to include high-latitude ionograms and also apply the technique to processing of topside ionograms.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0040, COMMUNICATIONS ADAPTIVE INTERNETTING
A.J. MCLAUGHLIN, Mass. Inst. of Technology, Lincoln Laboratory, *Lexington, Massachusetts* 02173 (DF306617; F19628-76-C-0002)

The goal of this program is the investigation and development of techniques for communications-adaptive internetting with particular application to command and control problems. The specific class of problems addressed requires the use of distributed ADP resources that are connected by a network whose communication links are time-varying due to natural or hostile actions.

A command and control computational task was implemented as a representative problem that required the utilization of local and remote resources that are connected by time-varying communications. The ARPANET was used as a means for implementing an experiment in which network hosts were used to perform command post ADP functions while characteristics of variable-rate line-of-sight and satellite channels were implemented in software on a host computer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Electronic Systems Div.

4.0041, STUDY OF PERFORMANCE OF INSTRUMENTED MANIKINS IN MEASURING THERMAL PROTECTION
E.T. WALDRON, U.S. Army, Natick Research & Dev. Command, *Natick, Massachusetts* 01760 (DA0F4280)

Determine sensitivity levels and data acquisition adequacy of instrumented manikins (both Air Force- and Army-developed) used to measure the thermal protection provided by aviators' and tankers' uniforms.

Utilize manikins instrumented with 'true' skin simulants and predict protection through standard techniques, such as equating burns with a damage integral of 1.0.

SUPPORTED BY U.S. Dept. of Defense, Natick Research & Development Command, Natick Development Center

4.0042, DESIGN OF MECHANISM FOR REFERENCING REAR DRUM OF LONG WALL SHEARER
E.W. JONES, Mississippi St. University, School of Engineering, *Mississippi State, Mississippi* 39762 (NCA 8-131)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0043, EFFECT OF STRUCTURAL PARAMETERS ON ROTOR BLADE VIBRATIONAL CHARACTERISTICS 14585-E
D.A. PETERS, Washington University, School of Engin. & Appl. Sci., *St. Louis, Missouri* 63130 (DA0F8964; DAAG29 77 G0103)

(1) To find the relationships between structural parameters and rotating beam vibrational characteristics; (2) develop an adequate model of the phenomenon; and (3) develop efficient computational methods for solving the problems of flap-lag-torsion vibrations of rotor blades. Relevance - highly relevant to current rotorcraft dynamics problems.

The approach will be theoretical using both modal and finite-element techniques.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0044, SPUTTERED MERCURY-CADMIUM TELLURIDE MATERIAL FOR INFRARED DETECTORS
R.H. CORNELY, New Jersey Inst. of Technology, School of Engineering, *Newark, New Jersey* 07102 (DF047800; AF-AFOSR-3249-77)

AF function - aerospace communications, surveillance and detection systems require electro-optical devices which exploit the special properties and interactions of infrared radiation with solid-state materials. Opportunity - materials sensitive in the far infrared region of the electromagnetic spectrum have a high impact on novel devices for airborne and satellite applications. Objective - the aim of this research is to deposit and examine single crystals of HgCdTe by radio-frequency, triode sputtering techniques, and to establish the dependence of material parameters such as band gap, carrier concentration and mobility, chemical composition and film stoichiometry upon deposition parameters such as Hg sputtering gas pressure, film deposition rate, and substrate material, temperature, RF bias and presputtering surface treatment. How work contributes - sophisticated electrooptical techniques in narrow band-gap compound semiconductors offer promise for electrooptical microcircuitry and for wide-angled infrared sensing in the 3-5, 8-14, and 18-25 micron spectral regions.

Obtain a detailed understanding of the conductive, optical and compositional properties of sputtered HgCdTe films by measuring Hall-effect and optical transmissivity and by utilizing Auger spectroscopy, electron and x-ray diffraction methods, and chemical analysis techniques. Explore the methods of forming p and n-type regions, by Hg vapor changes or simultaneous sputtering of dopants. Study trapping and noise phenomena in sputtered films using field-effect measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0045, NAVY VEHICLE DESIGN AND CONSTRUCTION - DISPLAY IMAGE DESCRIPTORS

R.W. COHEN, Radio Corporation of America, *Princeton, New Jersey* 08540 (DN475203; N00014-74-C-0184)

This task is to develop improved displays for Navy flight vehicles by formulating a set of descriptors that includes the transfer characteristics of human visual system and which are suitable for specifying a variety of imaging systems. The primary use of the descriptors is expected to be in the design and the evaluation of imaging systems by allowing designers to predict, for a given set of viewing conditions, observer reaction to changes of various display characteristics.

The contractor has developed a mathematical approach to display characterization based on information theory, experimental data from psychophysics, and image analysis. The approach will include analysis of one- and two-dimensional sampled displays, the effects of chrominance, and conclude in this phase with the demonstration of the applicability of the image quality parameters to a wide variety of display formats and the presentation of the results in a simple, practical format.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0046, FIBEROPTIC SUBSYSTEM COMPONENT INVESTIGATION

A.E. MARDIGUIAN, U.S. Air Force, Weapons Laboratory, *Albuquerque, New Mexico* 87117 (DF183460)

To study radiation damage mechanisms and to develop radiation-hardening techniques for optically coupled isolators, light-emitting diodes and photodetectors for fiberoptic data links. To determine the severity of detector blinding by radiation induced optical pulses in fiberoptic data links, and to develop solutions for this problem if necessary. Also, to study low-threshold and possibly radiation-resistant light sources for fiberoptic data links, specifically DH (double heterostructure) and SCH (separate optical and carrier confinement heterostructure) laser diodes. To characterize the radiation effects on newly developed optical fibers.

In each case, devices will be exposed to cobalt-60 neutron and flash X-ray radiation and pertinent electrical and optical parameters will be recorded. From this information, steps can be taken to assure the radiation insensitivity of these devices and further harden fiberoptic data links for operation in radiation environments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0047, SHOCK TUBE FACILITY

L.E. WILSON, U.S. Air Force, Weapons Laboratory, *Albuquerque, New Mexico* 87117 (DF166430)

The study of chemical kinetic and gas dynamic problems associated with gas lasers.

Chemical kinetic properties will be measured at room temperature using an absorption technique. A dye laser will be used to produce excited species and deactiviation rates will be measured by the change in absorption of a diode laser radiation through the gas sample.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0048, EVALUATION OF ENGINEERING SCIENCES RESEARCH RELEVANT TO CURRENT AND PROJECTED AIR FORCE INTERESTS

W.J. GALLAGHER, Polytechnic Inst. of New York, Graduate School, *Brooklyn, New York* 11201 (DF001080; F44620-72-C-0005)

Air Force function - aerospace vehicles, weaponry, air-breathing propulsion, rocket propulsion. Deficiency/opportunity - a highly selective procedure is necessary to assure the program of high-quality fundamental research necessary for advancing the frontiers of science of high relevance to the Air Force. In-depth expert research evaluation and advice on basic research pertinent to the areas of mechanics and energy conversion will be made available to AFOSR to supplement the in-house expertise of the Directorate of Aerospace Sciences in the formulation of the mechanics and energy conversion programs. Objective - to provide independent, critical reviews by highly qualified professionals of the AFOSR research plans and programs in mechanics and energy conversion and of the individual proposals and research studies which are submitted to AFOSR. How contributes - provides independent evaluation of AFOSR research programs, as well as advice pertaining to the preservation of the required high degree of scientific quality of the research.

The investigator will select, screen, and assemble experts to serve individually, and as members of panels, to evaluate AFOSR/NA research projects and programs, to provide special reports to AFOSR on individual research proposals and on state of knowledge in areas of interest to AFOSR. Recommendations concerning content and management of AFOSR research programs will be included in the scope of the evaluations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0049, MEASUREMENT OF KINETIC RATES FOR CARBON MONOXIDE LASER SYSTEMS

J.W. RICH, Calspan Corporation, *Buffalo, New York* 14221 (DF046450; F49620-77-C-0020)

AF function - the electrically excited carbon monoxide laser is one of the most efficient coherent radiation sources known. It has the development potential to cover a wide wavelength region in the infrared and the possibility of wide band-width tunability. These advantages and development potential have led to studies of the use of CO lasers in the Air Force high-energy laser and infrared avionics programs. Opportunity - extensive laser kinetic modeling computer codes have been developed to predict laser power, efficiency, and spectral distribution as functions of operating parameters. Such codes are valuable for predicting the performance of proposed laser systems. However, the predictive capability requires accurate knowledge of certain parameters that must be obtained experimentally. This program will provide such data. Objective - this program will provide measurements of optical cross sections and of gas-phase kinetic rates of importance for the performance prediction of carbon monoxide lasers being developed for the Air Force. Contributions - optical cross sections and gas phase kinetic rates have been measured in the last few years. However, there are additional rate data required as the emphasis on CO laser development moves into new areas.

Optical cross sections and energy transfer rates in CO laser systems will be measured in a high-pressure, flowing gas cell in which CO is optically pumped by a high-power CW CO laser. It is important to measure the following quantities: (a) the Einstein a coefficients of the infrared fundamental and first overtone of the vibrational states of the ground electronic state, (b) optical broadening cross sections and linewidths, (c) V-V rates for CO-CO for excited states up to V equals 30, (d) V-T rates for CO-HE and CO-AR up to V equals 30.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0056, SOLID-STATE MODULAR VOR

UNKNOWN, E D O Commercial Corporation, *Huntington Station, New York* 11746 (FA75WA-3617; FA058372 (TRAIS NO.))

Develop a modular solid-state VOR which can be configured as a conventional VOR, a Doppler VOR or an FM-FM PVOR. In addition, improved performance in terms of accuracy and stability is to be provided. The equipment will include automatic test capability which, in combination with the modular design, will permit more economical maintenance.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0051, INVESTIGATION OF THE FLUCTUATION MECHANISM IN TURBULENT FLOW

V. ZAKKAY, New York University, School of Science & Engin., *New York, New York* 10003 (DF042080; AF-AFOSR-2947-76)

AF function - advanced aerospace vehicles. Opportunity - better understanding of turbulent flows. Objective - investigate the propagation mechanism of pressure fluctuations in turbulent flows. How work contributes - improvement in our physical understanding of turbulent flows will result in improvement in our design capability of advanced aerospace vehicles.

An experimental program has been established to study the change in the large-scale disturbances, called 'bursts' due to introducing controlled sources of pressure fluctuations or changes in wall characteristics. An analysis will be made to determine how the changes in the turbulent structure due to these perturbations will affect overall skin friction and radiated noise.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0052, PRECISE REFRACTION CORRECTION SYSTEM FOR SLBM RADARS

L.E. TELFORD, U.S. Air Force, Rome Air Development Ctr., *Rome, New York* 13440 (DF901240)

AF function - improve techniques for providing tropospheric refractive bending and range error corrections for precision radar and navigation systems. Deficiency or opportunity - present methods for correcting for tropospheric refractive bending and range error assume a horizontally stratified atmosphere and rely on data collected at one surface site. For low elevation angles these methods usually fail since the ray traverses long horizontal distances and the assumption of horizontal stratification is not met. This results in unacceptable refraction correction for low elevation angle tracking. Objective -design, fabricate and test a three frequency millimeter wavelength radiometer system to provide atmospheric emission data which has been shown to improve low elevation angle refraction correction prediction. How research contributes - atmospheric emission data at millimeter wavelengths has been found to be of value in improving the prediction of refractive bending and range error at low elevation angles.

A prototype of a three-frequency radiometer system will be procured under contract and tested under pseudo-operational condition at one of the USAF precise radar sites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0053, SOLAR POWER SATELLITE RECTENNA DESIGN STUDY

R.J. GUTMANN, Rensselaer Polytechnic Inst., Graduate School, *Troy, New York* 12181 (NAS 9-15453)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0054, DYNAMICS OF STRUCTURAL CHAIN SYSTEMS

R.L. HUSTON, Univ. of Cincinnati, School of Engineering, *Cincinnati, Ohio* 45221 (DN323083; N00014-76-C-0139)

The technical objective of the proposed work is to research and develop a systematic, computer-oriented method for obtaining and solving equations of motion of general chain structural systems such as cables, chains, antennas, long flexible booms and aircraft-occupant dynamics. The dynamic equations of motion for such systems are highly non-linear due to the large geometric effects and the structural interactions.

The basic approach in the modelling of dynamical systems, whether they be cables, antennas or human bodies, is to represent the system by a series of connected rigid bodies. Algorithms based upon Lagrange's form of d'Alembert's principle then lead to a set of governing dynamical equations which may be solved numerically. These algorithms and the corresponding numerical procedures are currently being refined by using more sophisticated programming, technical advances in numerical analysis and in the theory of kinematics. Of particular significance in this latter regard is the use of Euler parameters which prevent geometrical singularities from arising during the course of a given solution.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0055, THE SURFACE CURRENT AND CHARGE DENSITY INDUCED ON FINITE CYLINDER MOUNTED NEAR A PERFECTLY CONDUCTING GROUND PLANE

W.D. BURNSIDE, Ohio State University, Graduate School, *Columbus, Ohio* 43210 (DF048710; AF-AFOSR-3324-77)

AF function - geometrical theory of diffraction (GTD) analyses have been used with the principle of reciprocity to analyse the surface current and charge density induced on an aircraft in an electromagnetic environment, as, for example, the nuclear electromagnetic pulse (EMP). The proposed work will apply the GTE technique to structures near a ground plane. Opportunity - previously developed solutions have been used to compute the surface current and charge density for aircraft in a free space environment; however, there is a need for this information when the aircraft is closely coupled with other structures, specifically, the coupling induced by a plane wave incident on a parked aircraft as in an EMP simulator test. Objective - the surface current and charge density induced on a finite cylinder situated above a perfectly conducting ground plane will be analyzed. This solution will be used to determine if large currents or charges are induced due to the open resonator effect, i.e., the finite cylinder and its image. Contribution - this work will provide some basic understanding of the mechanisms associated with closely coupled structures. Two-dimensional open resonator problems have been treated in past work which illustrated the applicability of GTD to solve such problems. However, many questions must be answered in the three-dimensional case which will be addressed in this work.

A GTD numerical solution for the surface current and charge density induced on a section of an infinite two-dimensional cylinder near an infinite ground plane. Using a GTD solution the three-dimensional effects associated with a finite strip and circular cylinder situated above an infinite ground plane will be examined. These two solutions will be combined to compute the total surface current and charge density induced on an infinite strip and circular cylinder near a ground plane. The work will be verified using another approach and also by determining if the solution provides the free space result as the cylinder is moved a large distance from the ground plane. An attempt will be made to qualify the resonator effect on the surface current and charge densities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0056, EXPERIMENTAL ANALYSES OF TRAILING EDGE FLOWS

K.D. KORKAN, Ohio State University, Graduate School, *Columbus, Ohio* 43210 (NSG 2298)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0057, SPECIFIC MISSILE MODEL

H. CARLSTROM, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF099730)

To study and evaluate the performance of various missiles (A A plus S A) against ECM and also by applying fixes (ECCM) on the missile side to observe the degradation of the ECM. As far as possible real flight conditions will be simulated, the output will be either misdistance or closely related misdistance.

This IH approach will utilize a Hawk missile to represent the threat. There are reasons to believe that the Hawk is a good representative of the class of semiactive guided missiles now widely in use. With the available hardware, one missile guidance section and one maintenance shop trailer, a functioning missile model will be set up in the anechoic chamber facility and readied for ECM tests.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0058, J-79 B/AL FOD IMPACT TRANSIENT ANALYSIS

P. COPP, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF460190)

The objective of this program is to establish a foreign object damage (FOD) transient stress analysis prediction model. Computer support services shall be required to conduct an in-house transient analytical simulation of starlings impacting J-79 B/Al composite blades.

The composite blades shall be modeled utilizing the NASTRAN finite-element computer program due to the availability of a transient analyses capability. Stress/strain failure modes of the composite blades will be identified. Two-dimensional bird impact loading functions developed from paralleling J-79 B/Al contractual studies shall be input to the finite-element model as a function of the chord distance and impact time. The actual three-dimensional J-79 B/Al blade will be modeled using NASTRAN and both isotropic and orthotropic material property models of the blade shall be analyzed. The experimental data obtained under the FOD improvement program being completed at General Electric shall be used for comparisons with the finite-element analytical results to define the reliability of these analytical methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0059, LAMARS F-106 INTEGRATED FLIGHT/FIRE CONTROL STUDY PROGRAM

R. GRESSANG, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF138310)

This program is divided into two phases. The objectives of the Phase I are: (1) to develop an in-house capability to perform integrated flight/fire control (IFFC) system analysis using the LAMARS moving base simulation facility, (2) to investigate the interactive dynamics of the sight/man/machine/target in air-to-air gunnery, and (3) to develop a rational system analysis procedure applicable to future IFFC system analyses, and evaluations. The objective of Phase II is to back up a director fire control system development and flight-test program with the LAMARS simulator to compare simulation results with flight-test results. The identical fire-control computer ancillary equipment and algorithms to be used in the flight test will be used in the LAMARS simulation.

Plan and conduct a joint program with AFAL, ADC, ADWC, USAFA and selected contractor support to: identify, obtain and integrate hardware and software on the LAMARS simulation facility to simulate the F-106 aircraft and three classes of fire control system sights; define realistic targets, performance measures, encounter geometries and scenarios; determine effect upon the performance measures of changes in problem parameters (sight, man, aircraft, target). Obtain and compare flight test data with data obtained in like conditions on the LAMARS simulator.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0060, AEROTHERMODYNAMIC AND SHROUD FLOW NOZZLES

F.J. HUBER, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF138600)

The development cost and time of advanced strategic missile and reentry flight vehicles have to be reduced. This can be achieved by obtaining accurate ground facility test data on aerodynamic heating and structural response of heat protection systems. Although it is not possible to completely duplicate flight conditions in a ground test facility, such as the AFFDL 50 MW facility, it is possible to closely duplicate the features of the flight air flow which control the phenomena to be investigated. The objective of this effort is to produce nozzles which will generate test flows that closely duplicate the flight pressure and heat flux distribution over the nose tip. This will be achieved with special streamline patterns of the arc-heated test air flow of the re-entry nose tip (RENT) test leg. The flared nozzle, developed in-house, produces a much wider and longer test region, and achieves a close duplication of the flight pressure and heat flux distributions over nose tip models. Still larger nose tip models can be tested by shrouding the hot, arc-heated air flow with an ambient temperature air flow of the same pressure and Mach number. The more accurate data which result from the use of larger models provide a more valid design basis. Because it is technically impossible to duplicate the flight air flow, regardless of the effort expended, these high-accuracy data cannot be obtained without these special nozzles.

Computer programs will be developed to model flow fields generated by flared nozzles of various contours. They will be used to predict pressure distributions around nose tip models of various sizes and geometries. One or more contours will be selected for a rent facility nozzle which will then be built and tested. The existing internal shroud flow nozzle of the rent facility will be tested further and, if necessary, modified to make it operational for customer testing. In addition, a nozzle to achieve maximum arc heater power and producing a slightly diverging test flow will be designed for the hypersonic test leg of the 50 mw facility.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0061, RPV IMAGERY LINK EVALUATION

F.T. HUTSON, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF097540)

The goal of this effort is to evaluate the effects of jamming on a jam resistant video data link. The determination of these effects will enable us to specify the target acquisition and data transmission hardware required for the RPV strike mission.

We will investigate the effects of jamming on a jam resistant video link using the following simulation: an in-house constructed image processor will perform a spatial transform (e.g., HADAMARD or HAAR transform) and coefficient selection for bandwidth reduction in real time, on data from any of several possible sources of dynamic imagery. This reduced bandwidth data will be A-J modulated, converted to l- or x-band and will be jammed using the communications system evaluation laboratory equipment in AFAL/AAD. The data will be demodulated and displayed on a monitor to a subject controlling the motion of the imagery source. The imagery source motion will either be made to approximate the flight characteristics of a drone (using a computer flight dynamics model), or it may be a gimballed camera mounted on an AMRL drone testbed. The testing will involve observation of the subject's ability to control the imagery source motion over a wide range of jamming conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0062, ACCELERATED LIFE TEST VERIFICATION FOR AEROSPACE NICKEL-CADMIUM CELLS

J.J. LANDER, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF455870)

To verify a proposed highly accelerated cycle life test deriving from work under 31452250 and 31452251 and a critique of the final report (AFAPL-TR-74-75), to verify the cycle life model proposed in the analysis 'Model Building and Prediction of NiCad Cell Cycle Life' (JJ Lander, 25 May 73) to accomplish the above with 'Pickett process' plates, to determine cycle life of cells made with 'Pickett process' plates (31452240).

Continuously cycle 5 cell groups at nine combinations of DOD and temperature (say 30, 50, 70 percent DOD and 60, 80 and 100 degrees F) after establishing initial capabilities. During first 200-300 cycles remove cells periodically for capacity checks each at the 1, 2, 4, and 6 C rates. Establish change in r and in intercept of i-v curves as proposed in the critique. From the latter establish slope of degradation when it becomes constant which is derived from the second derivative of degradation rate becoming constant. Predict life for each combination of DOD and T based on degradation rate curves. Match against curves at modelling report and predict life cycle to failure to correlate and establish cycle life of cells made with the 'Pickett process' plates.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0063, TURBULENT FLOW RESEARCH

J.H. LEE, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF136480)

Turbulence is an unsolved problem in fluid mechanics, yet one confronts it in every aerodynamic work. For this reason, we

are maintaining a long-range program for understanding the basic mechanics of turbulence and thereby developing new techniques that can be implemented to the engineering type of shear flows. At present, we are investigating the anisotropic effects in homogeneous turbulence. This is a first step toward formulating a deductive theory of shear flows. Also, engineering science techniques are being applied to Air Force applications.

Technically speaking, the rigorous treatment of turbulence involves statistical mechanical approaches, stochastic simulation, and model approaches of constructing dynamic equations which share certain features of the Navier-Stokes equations. Deterministic and stochastic solution techniques are used for various aircraft design problems, such as the turbulent gust load, angular vibration, and holographic interferometry.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0064, APPLICATION OF PHOTOMECHANICS TO EXPERIMENTAL STRUCTURAL ANALYSIS

G.E. MADDUX, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF134460)

Accurate stress analysis methods are required to accomplish low-cost design, development and maintenance of aerospace vehicles. These are used to secure structural integrity for safety and longevity of a system. The objective of this effort is twofold. The first is to apply laser/optical experimental stress analysis technology such as holographic interferometry and speckle photography to current design problems. The second is to improve and/or develop new laser/optical techniques with particular emphasis on reducing the cost of design analysis. The expected payoff is an improvement of in-house capability to advance the state of the art and to provide accurate and reliable analysis with a near-term impact on systems such as RPV, AFTI, AMST, ASALM, and B-1.

Under a completed exploratory development program (JON 14670212), specialized holographic and speckle photographic methods have been developed and exploited to experimentally validate finite-element stress analysis of structural components. This included strain field measurements around interference fit fasteners installed in fatigue resistant structural joints. The current effort will involve application of this technology to composite, bonded, and weld-bonded structures. Experimental studies concerning structural joints and the stress distribution in the vicinity of fasteners will continue. Techniques for using speckle photography on high-temperature structures will be investigated. New techniques which might improve accuracy or reduce analysis cost will be evaluated. A quick response in-house capability will be maintained to solve urgent problems that often arise but are easily disposed of using the unique techniques of photomechanics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0065, COMPRESSOR/TURBINE INSTRUMENTATION AND TRANSIENT ANALYSIS EQUIPMENT

D.L. MCCORMICK, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF451960)

To purchase high response instrumentation and data acquisition and handling equipment for use in the in-house test programs, i.e., T-63 compressor stability investigation, J-85 control synthesis program and adequate building of equipment to meet the needs of the compressor research facility. To maintain a forward-looking evaluation and development program for new instrumentation and sensors for possible use in engine research and development testing.

Determine future instrumentation needs of turbine engine research testing. Purchase the most compatible equipment, design an operable system, supervise installation in rooms 17 and 21, and prepare operating instruction handbook. Conduct detailed performance tests of critical subsystems as installed and prepare AFAPL TR based on results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0066, B-BAY UPGRADE

D.C. RABE, U.S. Air Force, Aeropropulsion Laboratory, *Dayton, Ohio* 45433 (DF458360)

The objective of this project is to upgrade the b-bay irradiation effects facility to produce output powers in the order of 25kw with good beam quality and to improve instrumentation of the system for complete diagnostics.

The approach will be to investigate the aerodynamic stabilization of the electric discharge in the CO2 gas laser and attempt to increase power input to the channel. Gas cooling will be investigated to help decrease the entrance Mach number so increased flow rates and pressures can be obtained. Instrumentation will be provided as with the present geometry.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0067, EXPERIMENTAL EVALUATION OF SAMPLING BIAS FOR LASER VELOCIMETERS

W.G. TIEDERMAN, Okla. St. Univ., School of Engineering, *Stillwater, Oklahoma* 74074 (DF048330; AF-AFOSR-3298-77)

AF function - advance aerospace vehicles. Opportunity - provide accurate velocity measurement by non-intrusive instrumentation even in regions of separated flow. Objective - to remove the ambiguities in laser velocimetry about biased sampling in naturally seeded flows caused by size distribution and velocity of the seed particles. How work contributes - will provide data and data reduction techniques to evaluate the limits of application of the laser velocimeter. This will provide a much needed information on the utilization of laser velocimeters now in use in Air Force wind tunnels, jet exhaust and rocket plume test facilities.

An experimental program will be conducted to determine the effect of particle arrival rate upon biased sampling and the effect of slow versus fast particles upon the probability of detection. The experiments will be conducted for both 5-10 micron and 0-10 micron seed particle distributions to determine the sensitivity of the threshold detection level to the size distribution of the particle in the flow.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0068, RESEARCH ON SINGULAR PERTURBATION TECHNIQUES FOR ON-LINE OPTIMAL CONTROL

A.J. CALISE, Drexel University, Graduate School, *Philadelphia, Pennsylvania* 19140 (NSG 1496)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0069, TURBULENT WAKE RADAR CROSS SECTION

P.E. BISBING, General Electric Company, *Philadelphia, Pennsylvania* 19101 (DF245930; F19628-76-C-0011)

AF function - advanced missiles and decoys. Deficiencies -inability to accurately predict the radar cross section of the turbulent wakes and plumes of reentry vehicles and decoys. How research contributes - recent flights of the SRAM (short-range attack missile) revealed some serious discrepancies between the predicted and observed radar cross section of the wake. It is the purpose of this program to develop an improved computer code which can remedy this deficiency. The code can be used as an aid in the design of decoys with wake properties which simulate these of a warhead.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Cambridge Research Labs.

4.0070, SIMULATION DEVELOPMENT SCENE GENERATOR SYSTEM

R.L. JONES, U.S. Navy, Air Development Center, *Warminster, Pennsylvania* 18974 (DN233164)

Research and develop the simulation capability to generate visual cues an air crew requires to accomplish earth-oriented operations such as landing on surface ships, air-to-ground weapon delivery and air-to-air combat.

The scene generator capability is being developed in several phases. The initial phase included the design of the gantry system and the development of the optical probe. The second phase is the development of the space and the lighting system. The third phase is the integration of the gantry, lighting and a terrain model and ship model with seascape.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0071, MATERIAL SUPPORT TECHNOLOGY - TRANSPORT PROPERTIES OF INGAAS SOLID SOLUTIONS AT HIGH ELECTRIC FIELDS

M. GLICKSMAN, Brown University, Graduate School, *Providence, Rhode Island* 02912 (DN575261; N00014-75-C-0565)

The Navy has applications for solid-state microwave devices that operate at higher frequencies and deliver more power. One material that holds promise of improved device performance is indium-gallium-arsenide. The contractor will ascertain the high electric field transport properties of this material and its suitability for transferred electron devices.

The contractor will measure the velocity-electric field characteristics of n-type samples of high-quality solid solutions of InGaAs. Measurements will be made on material epitaxially grown on GaAs substrates, and having values of composition corresponding to x between 0 and 0.25. Initial studies will focus on the measurement of the characteristics using short pulse and microwave techniques. In later stages, the focus will be on the theoretical analysis of the data to determine the scattering patameters of the material.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0072, SYNTHESIS OF DIGITAL FILTER STRUCTURES WITH LOW ROUNDOFF NOISE AND COEFFICIENT SENSITIVITY

L.B. JACKSON, Univ. of Rhode Island, School of Engineering, *Wakefield, Rhode Island* 02881 (DF043990; AF-AFOSR-3057-76)

AF function - to design optimal cost-effective digital filters for radar, communications, and telemetry systems. Deficiency - the advantages of digital signal processing are so compelling that the Air Force (as well as commercial communications companies) is gradually converting all communications systems to digital systems. However, because of short word lengths in microcomputers the errors due to truncation in the filter coefficients and data, and round-off errors in multiplying accumulate to the point where they cannot be ignored in filter design and analysis. Objective - to devise methods for estimating the output noise (the resultant of all the errors) of a filter in the design stage, preferably by formulas giving lower bounds that are independent of the many possible ways of realizing the same transfer function. The bounds must be nearly attained for some realization, to be useful. The goal is improved signal processing capability. How work contributes - success in this research could lead to dramatically improved digital circuitry for the various electronic systems used in aerospace vehicles and communications networks.

Work will be directed toward the study of digital filter structures with low output round-off noise and low coefficient sensitivities. State-space structures with demonstrably small noise properties will continue to be the principal area investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0073, BOUNDARY CONDITION AT A WIND TUNNEL WALL FOR A LIFTING WING BODY COMBINATION AT LOW SUPERSONIC SPEED

G. DROUGGE, Aeronautical Res. Inst., *Bromma, Sweden* (DF048170; AF-AFOSR-3282-77)

AF function - aerospace vehicles, air-breathing propulsion. Deficiency - lack of adequate correction methods for wind tunnel data for lifting configurations at transonic speeds. Objective - to experimentally and, if possible, theoretically determine the wall-boundary conditions for a lifting wing-body model at high transonic speeds. How work contributes - wind tunnels are often mainly used for development testing of aircraft and missiles. While tests have shown that for non-lifting models, the wall interference is far from negligible and that the results can in most cases be considered as acceptable for routine testing very little is known about the required wall characteristics for a lifting aircraft configuration. If the wall criteria resulting from this investigation agree reasonably well with the criteria used for the development of existing tunnel walls, the assumption that these walls are the most suitable for routine testing will be confirmed. If the results disagree new ideas will be generated concerning necessary modifications of existing walls or possible new wall configurations will be proposed.

By measuring the flow about a hypothetical cylindrical surface surrounding a lifting model the boundary conditions at a hypothetical test section wall will be determined. Comparison will be made with the calculated flow around the same wing-body combination using a computer program already available at FFA.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0074, DATA CORRELATION AND AQUISITION PROGRAM (DCAP)

R.K. MATTEWS, Arnold Research Org. Inc., *Tullahoma, Tennessee* 37389 (DF420985; F40600-75-C-0001)

A multichannel data system will be designed and fabricated to acquire and record wind tunnel-flight test data. The system will be designed to fit into existing external stores such as the BDU-12 and will be completly self-contained. Measurements on the store in the wind tunnel and in flight will include temperature, pressure, heat-transfer rate, tine, and voice channel. Check-out of the data acquisition system will be accomplished in the wind tunnel and in flight.

To define aerodynamic heating and thermal environmental effects on the design and operation of externally-carried stores requires both a wind tunnel and flight test program which will yield not only the primary data such as store temperatures, but also aerodynamic measurements of heating rates and pressure distributions, and therefore a specially designed airborne data acquisition system for measuring and recording of data for subsequent analysis is needed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering & Development Center

4.0075, ANALYSIS OF THE ROCKET EXHAUST FLOW FIELD IN A NON-TIPOFF LAUNCH TUBE

J.J. BERTIN, Univ. of Texas, School of Engineering, *Austin, Texas* 78712 (DA0L4991)

To determine the effects and causes of blow-by missile exhaust gas flow (both massive and secondary) on a missile trajectory when fired from various launch tube designs. A description of the exhaust gas flow field between the missile body and launch tube will be formulated and will provide a tool for future launch tube evaluation.

Many rockets are launched from 'non-tipoff' tubes which have constrictive changes in cross section. The rocket motion is constricted for a short interval of time and then flies free as it emerges from the tube. The rocket exhaust flow field in the tube may result in 'blow-by flow' in which exhaust gases are directed upstream into the annular region between the rocket and the launcher wall. The 'blow-by flow' can be either massive or secondary. This effort will complete the current investigation of a rocket-launcher configuration which involves measuring the pressures acting on the rocket when massive blow-by occurs, to determine the effect of massive blow-by flow on the initial portion of the free flight rocket trajectory. The work will be performed at the University of Texas, utilizing their rocket exhaust effects facility (cold gas). The beginning date of the contract is July 1977 and the estimated completion date is March 1987.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Ground Equipment & Materials Directorate

4.0076, EXPERIMENTAL MEASUREMENTS IN UNSTEADY TURBULENT BOUNDARY LAYERS WITH PRESSURE GRADIENTS 13367-EX

R.L. SIMPSON, Southern Methodist University, School of Engineering, *Dallas, Texas* 75222 (DA0E9056; DAAG29 76 G0187)

To obtain fundamental experimental data of accelerating and decelerating unsteady turbulent boundary layers in order to improve understanding of turbulent flow structure near unsteady separation. The research will fulfill, in part, the requirement for experimental verification of theoretical analysis for unsteady turbulent boundary layers, the characteristics of which control the dynamic stall of helicopter rotors.

An experimental investigation utilizing a wind tunnel with downstream rotating damper blades to produce an unsteady turbulent boundary layer will be conducted. Detailed turbulence structure measurements using hot-film and laser anemometry will be made all along the length of the test section.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0077, F-111 WIND TUNNEL MODEL REWORK

A.B. RILEY, General Dynamics Corporation, *Fort Worth, Texas* 76101 (DF640510; F04606-75-D-0114)

(1) The modifications to the F-111 model will support store separation studies. (2) The use of the F-111 wind tunnel model will allow the determination of safe store separation envelopes before full-scale flight tests. (3) The goal of this task is to modify the present model so that more extensive wind tunnel data can be obtained. (4) The data that will be gained with the aid of the modified model will provide increased accuracy in predicting store separation characteristics.

The addition of a weapon bay, internal balance, and aircraft empennage will allow all necessary testing to be conducted. These modifications were planned for during the construction of the original model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

4.0078, MAN-MACHINE ANALYSIS OF TRANSLATION AND WORK TASKS OF SKYLAB FILMS

W.W. HOSLER, Univ. of Houston, Graduate School, *Houston, Texas* 77004 (NAS 9-15521)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0079, WIDEBAND FIBER OPTIC DATA LINKS

G. PITTMAN, Spectronics Incorporated, *Richardson, Texas* 75080 (DF105450; F33615-76-C-1047)

The objective of this effort is to demonstrate flightworthy and operational system compatibility aspects of wideband fiber optic point-to-point links. Recent experiments have shown that available fiber optic technology can be used to satisfy low data rate requirements within modern aircraft. Wideband operation is significantly more difficult and has not been demonstrated in an airborne mode.

Two wideband fiber optic data links will be designed, fabricated, and installed on an RC135 a/c for performance evaluation during operational flight tests. The links will be designed to interconnect (1) the ARC-259-41A, IF processor, and the QRC-259-51, pan display (160 mHz bandwidth) and (2) two QRC 245A (T)-LA-L VIDIS video distribution units (20 mHz bandwidth). A final report will be prepared after flight tests are completed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0080, LASING AND COMBUSTION STUDIES OF FAST-FLOW SYSTEMS

R.A. COOKSON, Cranfield Inst. of Technology, *Cranfield, England, United Kingdom* (DF038990; AF-AFOSR-2698-74)

AF function - advanced air-breathing engines and high-power chemical lasers, weapon delivery and defense. Deficiency - insufficient understanding of the basic mechanisms and processes associated with coherent radiation produced from reaction products of hydrogen or hydrocarbon/air and gas dynamic/combustion aspects of fast flow reacting systems, lack of realistic guidelines for predicting properties and feasibility of electronic transition lasers produced from hydrogen and/or hydrocarbon fueled systems and of supersonic combustion systems. Objectives - to understand and develop theoretical and mathematical models realistically describing the mechanisms and processes associated with lasing and supersonic combustion phenomena in hydrogen and hydrocarbon fuel-air mixtures. How work contributes - will provide additional understanding of the chemical lasing and supersonic combustion phenomena not now available and will contribute to the technology base required for realistic evaluation of the potential and development of improved high-power chemical laser and combustor devices based on fast flow combustion.

Investigation will be made of the feasibility of constructing and operating a lasing system in the 4 eV energy range using a high-enthalpy combustion facility. Emphasis will be placed on hydrogen or hydrocarbon fuels reacting in both the slow speed and supersonic flame modes to produce an electronic transition OH chemical laser. Mechanisms for the excited-state OH formation will be investigated. Measurements will be made of the OH concentrations, OH self-absorption, absorption by combustion products, excitation and depopulation rates, etc., and the data used to determine whether gain exists in any of the vibro-rotational lines and the OH lasing efficiencies. Similarly, an extensive spectroscopic study in hydrocarbon fueled systems will be made to determine rate constants for CH and C2 radicals. Also, study will be made of the IR emission within the ground and first electronic excited states of OH, CH and C2 radicals produced via combustion of hydrogen and hydrocarbons to discover what gain/loss exists. In addition, study will be made of chemical reaction phenomena in supersonic air streams, including the effect of combustor geometry, ignition, fuel injection modes, on enclosed supersonic liquid and gaseous hydrocarbon-air diffusion flames. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0081, PARAMETRIC AND NONLINEAR MODE INTERACTION BEHAVIOR IN THE DYNAMICS OF STRUCTURES

A.D. BARR, Univ. of Dundee, *Dundee, Scotland, United Kingdom* (DF039630; AF-AFOSR-2723-74)

AF function - Air Force flight vehicles require that improved knowledge and understanding of the dynamic behavior of structures be achieved so that future systems can be designed safely. Opportunity -experiments conducted by this research will provide data for correlation with theoretical models of nonlinear structural dynamics. Objective -the objective of this research is to investigate the parametric and nonlinear inertial response of structures typical of airframe and wing/store configurations. How work contributes - this research contributes to the technology base necessary in the reliable design of highly efficient and optimized flight structures which operate in a dynamic environment.

The principal investigator supported under this research grant has previously conducted theoretical research leading to models for predicting the nonlinear and parametric response of structures. Experiments seeking to correlate these models are supported by this research grant. In particular, experiments simulating the aft fuselage, horizontal off-set tail and vertical tail are being conducted. These structural elements are designed based upon existing theories to exhibit parametric response. The model is mounted on vertical shakes to provide controlled excitation of either force or displacement type.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0082, THREE-DIMENSIONAL FRACTURE

E.S. FOLIAS, Utah Higher Education System, School of Engineering, *Salt Lake City, Utah* 84112 (DF047440; F49620-77-C-0053)

AF function - advanced aerospace flight vehicles and propulsion systems require improved damage tolerance. Deficiency - the inability to accurately and efficiently assess fracture and crack growth which involve three-dimensional behavior seriously limits the Air Force capability to develop realistic structural damage criteria. Objective -objective of this theoretical research is to investigate the three-dimensional behavior of surface and corner cracks with particular attention being given to the region where the crack intersects the structural free surface. How work contributes - the research directly contributes to the Air Force research effort seeking to develop a realistic three-dimensional fracture criteria and crack growth law which has experimental validity.

This research effort, using the three-dimensional theory of elasticity, will study the behavior of surface and corner cracks. The stress singularity behavior at the intersection of a corner crack and free surface will be studied. In addition, for surface cracks the stress distribution in the vicinity of the crack surface will be determined and the influence of the rear surface proximity studied. Using perturbation analysis the advancement of a crack front will be investigated in an effort to explain 'tunneling' behavior.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0083, COMPOSITE STRUCTURE OPTIMAL DESIGN BY ENERGY METHODS
R.W. MCLAY, Univ. of Vermont St. Agr. Col., School of Technology, *Burlington, Vermont* 05401 (DF042370; F44620-76-C-0012)

AF function - advanced aerospace flight structures require increased durability and performance efficiency. Opportunity - advanced composite materials potentially can fulfill these Air Force requirements in a number of primary structural applications. Objective - the objective of this research is to develop a basic mechanics theory of fracture behavior in order to predict both fracture initiation and fracture surface directional dependence for advanced composites. How work contributes - this research supports the technology base related to advanced composite applications for airframe and engine primary structure.

Research is planned on both a theoretical and experimental level. Theoretical research will continue to develop the maximum entropy rate production theory for predicting fracture behavior. This theory will be used in conjunction with finite-element analysis methods for solving fracture problems in composites and examining the accuracy of the solution results. Experimental research will be pursued to obtain the fracture energy parameters required by the theory and to provide experimental data for comparison with predictions. Interface parameters will be studied especially under conditions where the environment affects the interface toughness. Reliable experiments to measure the parameters must be developed as part of the research effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0084, RELIABILITY AND MAINTAINABILITY (R&M) ASSESSMENT OF FIELDED SUBSYSTEMS
UNKNOWN, Unified Industries Inc., *Alexandria, Virginia* 22304 (FA77WAI-784; FA160428 (TRAIS NO.))

A list of existing subsystems that are likely candidates for improvement as mutually determined by contractor and the FAA's technical officer. This will be determined from: Existing data available at FAA Headquarters; Data obtained directly from the field if the FAA Headquarters data proves inadequate; If data are not readily available, the contractor shall, as appropriate, excerise his best engineering estimates in lieu thereof.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, ATMOSPHERIC INTERACTION STUDIES
J.F. MEAGHER, U.S. Tennessee Valley Auth., Div. of Environ. Planning, *Sheffield, Alabama* 35660 (D6-E721-DL; V625B-38)

The objective of this project is to determine the chemical interactions of emissions from coal-fired power plants with emphasis on the rate of oxidation of SO2. The goal is to predict the concentrations of major constituents at various locations downwind. Highly instrumented aircraft measure the fluxes of the constituents through the plume at a number of downwind distances. Pertinent meteorological parameters are measured with instruments on the aircraft and a ground station. These data will be utilized to develop a plume chemistry model which will detail the plausible mechanisms and kinetics of chemical reactions occurring in the plume and the meteorological influences on these reactions. Chamber studies of stack gases are also being initiated to obtain some fundamental information on plume chemistry. Emphasis for the immediate future studies will be placed on obtaining rates of oxidation of SO2 in stack gas.

Two studies were conducted in October 1976 and August 1977 at TVA's Cumberland Steam Plant. This plant has two 1300-MW units each fitted with a 1000-foot stack. The second study was to determine the effect of increasing the particulate mass loading on the conversion of SO2 to sulfate. Sections of the electrostatic precipitator were turned off to increase the particulate concentration. Preliminary results indicate little or no effect of mass loading on the conversion of SO2 to sulfate. At distances of 5 to 120 kilometers (0.16 to 11.0 hours of drift) downwind from the power plant the SO2 to sulfate conversion was less than 2% per hour. A milestone report on the SOx power plant plume chemistry is due in November 1978.

The construction of the reaction chamber is complete with equipment installation to be completed in January 1978. A milestone report on the photooxidation of SO2 is due in May 1979.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Energy Minerals & Industry

5.0002, DIAGNOSIS OF TROPICAL MOTION SYSTEMS
M. YANAI, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (ATM76-81393)

The ultimate objective of this research is to analyze data collected during the Barbados oceanographic and Meteorological Experiment (BOMEX) and the Global Atmosheric Research Program's (GARP) Atlantic Tropical Experiment (GATE) in an effort to gain a better understanding of the tropical atmosphere. To do this, advanced diagnostic methods will be developed; especially those that address the interactions between cumulus cloud ensembles and the motion and thermal structure in the lowest kilometer of the atmosphere. In addition planetary-scale tropical waves and their association with satellite measured cloud fields will be studied.

The tropics are considered to be the energy source for the atmosphere. An understanding of its dynamics and structure is vital to the problem of weather prediction.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0003, EARTHQUAKE RESEARCH - PREMONITORY MODELS AND THE PHYSICS OF CRUSTAL DISTORTION
J.H. WHITCOMB, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (NSG 5224)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0004, NORTH PACIFIC EXPERIMENT (NORPAX) - AIRCRAFT MONITORING OF THE EQUATORIAL CURRENTS DURING THE NORPAX TEST SHUTTLE
W.C. PATZERT, Univ. of California, Scripps Inst. of Oceanography, *San Diego, California* 92038 (OCE76-80183 A01)

This project is part of the North Pacific Experiment (NORPAX). The long-range goal of NORPAX is to understand fluctuation in the upper layers of the Pacific Ocean with time

scales of months to years and space scales in excess of 1,000 kilometers, and the relationship of these oceanographic fluctuations to the overlying and adjoining atmosphere. Achievement of this goal should eventually lead to improved weather/climate prediction for both the Pacific Ocean and North America.

As part of NORPAX this project will obtain data from aircraft on the large-scale characteristics and variability of the oceanic temperature field during the NORPAX-FGGE test shuttle. The objective of the shuttle is the design of a proper observational program to monitor the low-frequency (months to years) fluctuations of the equatorial Pacific oceanic circulation with the aim to understand its dynamics. The component proposed here consists of ocean and atmospheric measurements from NOAA and Navy aircraft. These data would be obtained during flights between Honolulu, Hawaii and Papeete, Tahiti beginning in November, 1977 and ending in February, 1978. The primary oceanic measurements will be closely spaced AXBT soundings sampled primarily along north-south sections repeated at time intervals varying from daily to weekly.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0005, SYNCHRONOUS ALTITUDE ATLAS
F. RICH, Univ. of California, Graduate School, *San Diego, California* 92037 (DF247760; F19628-77-C-0014)

AF function - AF satellite systems operate at synchronous altitudes where charging occurs and this in turn produces systems anomalies and degradation. Deficiency - the plasma environment responsible for spacecraft charging is not well understood. Objective - to develop environmental specifications of the geosynchronous plasma and field environment. How research contributes - plasma data from ATS-5 and 6 satellites will provide an environmental specification of the operating environment for AF synchronous satellites. The data will be used to typify the geosynchronous plasma environment's characteristics such that satellite charging mechanisms may be understood.

The University of California at San Diego will perform a statistical analysis of the geosynchronous plasma parameters and their relation to charging events. An environmental data atlas based on ATS-5 and 6 data will be prepared to include plasma parameters typifying quiet and disturbed conditions. The atlas will serve as the basis for a geosynchronous environmental specification.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0006, LIDAR TECHNIQUES FOR MEASURING PARTICULATE POLLUTANTS FROM ENERGY PRODUCTION AND THEIR TRANSPORT AND DISPERSION PROCESSES
V.E. DERR, U.S. Dept. of Commerce, Wave Propagation Laboratory, *Boulder, Colorado* 80302 (D5-E693-EB; V625C-70)

OBJECTIVES: 1. Develop lidar techniques for tracing and analyzing pollutants. 2. Develop Doppler lidar techniques for measurement of pollutant transport processes.

APPROACH: 1. Use independent multi-wavelength lidar transmissions and depolarization information to identify and distinguish natural aerosols and those resulting from man's activities. Study uses of differential absorption and inelastic scatter for aerosol identification. Utilize lidar in feasibility studies of smoke-stack plume tracings. 2. Develop CO2 Doppler lidar techniques for measuring wind velocity in the 'clear' air. Measure stack velocities and wind and turbulence profiles.

CURRENT PROGRESS: 1. Lidar Techniques. The polarization sensitive lidar has demonstrated an ability to distinguish coal-fired stack emissions from newly risen strip mine dust and to follow the plume as it moves under the influence of winds and terrain. The two-wavelength lidar (.694 and .347 micron) has been used to distinguish between stack emission, ambient dry aerosols, and cooling pond clouds. 2. Doppler Lidar. Wind and turbulence profiles have been measured under a variety of terrain and atmospheric conditions by using an operational, field-tested Doppler lidar. We continue to improve the scanning and data processing capabilities of the system to better meet pollutant transport measurement needs. A major milestone is 06/78, to use an offset local oscillator to extract a small mean velocity component from a large-turbulence stack effluent situation.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Energy Minerals & Industry

5.0007, RESEARCH IN AIR POLLUTION METEOROLOGY
L.E. NIEMEYER, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (D7-0305; G603A-AK-02)

This is one of a multi-part project whose summary may be identical to others.

The research effort includes the continuing development, evaluation, and validation of air quality simulation models, both for inert and reactive pollutants. Users will be provided access to these models through the EPA User's Network for the Applied Modeling of Air Pollution (UNAMAP). New concepts and technologies will be developed and adapted for improving the weakest components of existing models, with emphasis on the effects of topography, pollutant removal and conversion processes, and complex sources. Other activities will be directed toward the determination and definition of the effects of pollutant emissions on visibility, weather, and climate. Further studies will be conducted in air pollution potential climatology.

Participation will continue in the Regional Air Pollution Study (RAPS). The field portion of the study will terminate in Spring, 1977, and analysis and use of the data for model evaluation and verification will be initiated.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0008, DYNAMIC IONOSPHERIC MODELING
K. PAPADOPOULOS, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN120192)

To develop a three-dimensional dynamic model of the turbulent and laminar ionosphere by developing electrostatic fluid codes to accept data available from SOLRAD and other sensors, thereby providing the capability to theoretically predict the paths of ionospherically propagated systems. To provide a theory for ionospheric scintillation phenomena.

Multidimensional reactive flow electrostatic fluid codes that solve the equations of motion of a chemically reactive compressible fluid in a magnetic field will be used to study the response of the ionosphere to the deposition of solar radiation and to ionospheric currents. New data on the composition of the ionosphere will be incorporated, and its influence evaluated. Plasma instabilities responsible for scintillation phenomena will be studied with the goal of deriving density fluctuation spectra.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0009, EQUIPMENT FOR AN OCEANOGRAPHIC CURRENT METER FACILITY
P.P. BEDARD, Nova University, Physical Oceanographic Lab., *Dania, Florida* 33004 (OCE77-23265)

This award will provide expanded capabilities at the Nova University Physical Oceanographic Laboratory to furnish services to the oceanographic community for the design and development of oceanographic current meter arrays. The equipment to be acquired will increase the number and size of arrays available, allowing more flexibility for Nova in planning and designing moored current meter arrays, and providing greater access to the facility by the scientific community.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0010, PERTURBATIONS IN TROPOSPHERIC OH DUE TO ANTHROPOGENIC EMISSIONS OF CO AND NOX
W.L. CHAMEIDES, State University of Fla. Sys., School of Arts & Sciences, *Gainesville, Florida* 32601 (NSG 1497)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0011, ANALYSIS OF GEOID
D.C. BROWN, Duane Brown Assoc. Sys. Inc., *Melbourne, Florida* 32901 (DF277900; F19628-76-C-0065)

AF function - weapon systems navigation and delivery. Deficiency -launch site, target position, and geoid uncertainties degrade accuracy of weapons delivery. Objective - analysis of geoidal form. How research contributes - provides a new means for determining geoid shape over ocean areas.

Contractor will perform first-look data analyses on satellite altimetry data collected during GEOS-C program. Data will be used to determine geoid form over ocean areas.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0012, METEOROLOGICAL MEASUREMENTS BY SYNTHETIC RADAR
J.I. METCALF, Georgia Inst. of Technology, Graduate School, *Atlanta, Georgia* 30332 (NSG 5220)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0013, POLARIZATION DIVERSITY APPLIED TO METEOROLOGY
J.I. METCALF, Georgia Inst. of Technology, Georgia Technical Res. Inst., *Atlanta, Georgia* 30332 (DF248430; F19628-77-C-0066)

Af function - improvement of radar detection and identification of aerospace operational hazards. Deficiency - degradation and ambiguity in radar displays because of weather. Development - investigate polarization techniques for interpreting radar information and eliminating extraneous radar echoes. How development contributes -provides improved detection, identification and interpretation of weather echoes in radar displays.

A critical literature survey is being conducted.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0014, STUDY OF PHYSICAL PROCESSES AFFECTING WATER ICE ON OUTER SOLAR SYSTEM OBJECTS
C.B. PILCHER, Univ. of Hawaii, Graduate School, *Honolulu, Hawaii* 96822 (NSG 7403)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0015, AN ALGORITHM TO GENERATE INPUT DATA FROM METEOROLOGICAL AND SPACE SHUTTLE OBSERVATIONS TO VALIDATE A CH4-CO MODEL
L.K. PETERS, Univ. of Kentucky, School of Engineering, *Lexington, Kentucky* 40506 (NSG 1501)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0016, SYSTEMS RESEARCH FOR REMOTE SENSING OCEAN SURFACE CIRCULATION USING THE SEASAT-A SATELLITE
B.D. MARSH, Johns Hopkins University, School of Arts & Sciences, *Baltimore, Maryland* 21218 (NSG 5225)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0017, THREE-DIMENSIONAL SLOPE AND VALLEY WIND SYSTEMS 12461-GS
W. TANG, Ecological Enterprises Inc., *Bedford, Massachusetts* 01730 (DA0T5572; DAAG29 76 C 0007)

To model variations in wind circulations in a three-dimensional slope and valley-plain terrain situation, coupling the interactions between the upper air flow and the thermally induced lower level winds which vary diurnally. Relevance - three-dimensional modeling of air motion over complex terrain has relevance to transport and diffusion of obnoxious materials - for identifying optimal conditions for laying smoke screens, for wind effects on artillery accuracy, low-level helicopter operations, and other Army activities in mountainous terrain. The study should contribute to the development of operational terrain effect models for the Army's automatic meteorological system.

The research involves the development of the governing differential equations for air motion and temperature above mountain-valley terrain. The equations will be solved numerically and the results checked with analytical solutions and with real data.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0018, RESEARCH INTO RADIATIVE TRANSFER MODELING AND APPLICATIONS
UNKNOWN, H S S Incorporated, *Bedford, Massachusetts* 01730 (DF248650; F19628-77-C-0202)

AF function - reconnaissance, communications, surveillance, guidance, target acquisition and tracking. Deficiency - no operational capability exists at the present to remotely measure, from a satellite, the surface visibility and other optical parameters, necessary for the determination of the atmospheric contrast reduction. Objective - assess the applicability of the various methods for satellite-based remote measurements, of the optical properties of the lower atmosphere, to the determination of slant path contrast reduction or atmospheric transmission for aircraft viewing geometries. How research contributes -results could lead to the development of methods of using satellite-based measurements which permit the prediction of how well an aircraft in the tactical environment could see objects on the ground.

Conduct a critical review of the published and other concepts for remote satellite measurements of the atmospheric optical properties in terms of their ability to yield the information necessary for determining the contrast reduction for slant paths in the lower atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, AIRBORNE EQUATORIAL SCINTILLATION STUDIES
J. BUCHAU, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249070)

AF function - communication through disturbed ionospheres and AFSATCOM. Deficiency - prediction and real time specification of the ionosphere. Objective - to determine the effects of equatorial f-layer irregularities on satellite-to-aircraft vhf propagation. How research contributes - correlation of airborne and ground-based simultaneously obtained scintillation data allows extrapolation from the large ground data base to the airborne case. Payoff will be in terms of assessment of airborne scintillations over a whole solar cycle and on a global scale. It will support improvements in design and operation of vhf and uhf communication systems. Improvements are in terms of bandwidth, power requirements, frequency measurement, system accuracy and reliability assessment, modulation techniques, and operational procedures.

The Airborne Ionospheric Laboratory which is equipped to receive vhf transmissions from satellites and instrumented for ionospheric studies conducts flights in equatorial regions, in conjunction with extensive ground-based experiments. Flight paths are chosen to optimize investigation of the equatorial irregularities to include their formation, their latitudinal structure, and their effects on the satellite signals. The aircraft data will be correlated with the ground-based observations to permit extrapolation of the more extensive ground data base to be extended into the airborne domain. Satellites used in these studies are the LES 8/9 MARISAT and ATS satellites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, ELECTRON INDUCED ATMOSPHERIC BACKGROUND INFRARED EMISSION
A.R. FAIRBAIRN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249380)

AF function - detection, surveillance, early warning, reconnaissance, target acquisition. Deficiency - optical and infrared background fluctuations interfere with and degrade performance of detection systems, auroral event and nuclear detonations, contribute strongly to the background fluctuations. The chemical and physical effects of these phenomena, which both deposit electrons into the upper atmosphere, are not well enough understood to allow proper correction to be applied to sensor outputs to eliminate or minimize the interference. Objective - atmospheric gases in the range 0 - 10 Torr will be excited by low-energy (0 to 10 kEv) electrons. Because of the low pressures and expected two currents, the intensity will be low and a cooled background chamber will by used to enhance signal-to-noise ratios. Primary observation will be made in the 1-25 micron wavelength region with back-up measurements as needed. Data will be analyzed for infrared processes and yields. How research contributes - will aid in target acquisition against a perturbed background.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, OPAQUE ATMOSPHERIC OPTICAL MEASUREMENTS IN EUROPE
R.W. FENN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF244270)

AF function - reconnaissance, communications, surveillance, guidance, target acquisition and tracking. Deficiency - the performance of any optical system looking through the atmosphere is significantly degraded by atmospheric light scattering and absorption and it, therefore, depends in a complex way on the variability of the state of the atmosphere in the theater of operation. Objective - establish, as part of a joint program of NATO countries, a station in northern Germany for measurements of various visual and infrared atmospheric optical parameters on a routine basis over a period of approximately two years. Identical measurements will be conducted at several other stations instrumented by other NATO countries. How research contributes - from this measurement program a data basis will be derived which will allow to develop a climatology of atmospheric optical parameters. These data can be used to answer questions on frequency of occurrence of various atmospheric optical IR properties and their effect on EO/IR weapons systems.

A trailer, instrumented at AFGL, is being installed at a site in northern Germany near Meppen at the German Army proving ground. This station will be one of 7 stations set up by 8 NATO countries in Europe. Instruments for visible/IR transmission, illumination, contrast transmission, laser scattering, turbulence will record data automatically 24 hours a day. Data from all 7 stations will be consolidated in a common format on magnetic tape by the opaque data bank in the UK and distributed to all participating countries on magnetic tape, together with some limited statistical analysis. More detailed scientific analysis for statistics of data and correlations between ATM, optical properties and meteorology will be performed inhouse at AFGL.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, STRATOSPHERIC COMPOSITION
C.C. GALLAGHER, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF244790)

AF function - military operations of the B-1, F-15 and other AF vehicles in the stratosphere. Deficiency - the environmental effects of AF stratospheric operations cannot be predicted because of a lack of knowledge of the normal species concentrations and their spatial and temporal variations. Further, the mixing properties and chemical interactions of jet engine or missile effluents are only poorly defined. Objective - develop the instrumentation, methods and techniques to determine stratospheric gaseous composition, especially minor species, and conduct an initial stratospheric sample collection program. How research contibutes - the composition data is absolutely essential for the development of environmental impact assessment models which will aid the Air Force in establishing stratospheric standards and criteria.

Stratospheric air samples will be obtained at various latitudes and altitudes utilizing cryogenic whole air samplers installed on balloons and aircraft. The gas samples will be retrieved and quantitative laboratory analysis of the gaseous composition will be made with a gas chromatograph, mass spectrometer and a detector for nitrogen oxides.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, PROBABILITY MODELS OF JOINT OR SIMULTANEOUS OCCURRENCES OF WEATHER EVENTS
I.I. GRINGORTEN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249250)

AF function - planning of operations that require knowledge of risk of joint occurrences of the weather that are either simultaneous over wide areas of terrain or are successive events during an Air Force mission. Deficiency - improvement is required, not only in the simple knowledge of joint probabilities, but in the objectivity and the rapidity with which an evaluation can be made of the probabilities that a multiphased mission, anywhere in the world, will succeed. Objective -to obtain the probabilities of joint occurrences of weather events at several alternative bases or targets or over wide areas of terrain. How development contributes - by providing estimates of the climatic risks to the planned operations that are not obtainable directly from the climatic record.

Model fitting will be continued to estimate probabilities of such events as rainfall and windspeed on a given 'floor space', introducing the duration of the phenomenon like 3-hour versus 24-hour or 48-hour events. Monte Carlo simulation will have further application in the exploration of the joint probabilities of events at two or more stations occurring simultaneously or at differing times, and the combined effects of duration and areal extent.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, RECOVERY OF STATION POSITIONS AND GEOPOTENTIAL COEFFICIENTS
G. HADGIGEORGE, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF254740)

Air Force function - tactical and strategic weapons delivery. Deficiency - there is a need for improvement in the positional relationships between launch site and target. Objective - reduction of geodesy and gravity contributions to missile guidance errors, by development of new computational techniques. How research contributes -this work is directed toward improving the model of the earth's gravity potential and improving knowledge of launch site to target positional relationships.

A detailed and precise determination of the geoidal contours of the North Atlantic area will be made from satellite altimeter data. A combination of satellite altimetry data and land gravity data will be used to determine the geoid shape around the world.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, SURFACE OBSERVATION AUTOMATION
W.S. HERING, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF243800)

AF function - local airfield and missile base operations. Opportunity - provide more accurate and timely weather observations at reasonable operating cost. Objective - develop and evaluate weather sensors as required to assist the Air Weather Service in the change over from manual to automated methods of surface weather observing. How development contributes - field experiments are designed to develop and identify observing techniques that offer the greatest potential for effective automated measurement of significant local weather elements.

Direct evaluation of sensor performance characteristics will be made through the establishment of a prototype automated observing system for operational test purposes. Development will center on those elements where satisfactory solutions for automation do not exist. Included are evaluations of sensors for runway

visual range, prevailing visibility, slant visual range, ceiling and sky cover.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, OPTICAL OBSERVATIONS OF DEEP SPACE OBJECTS

S.P. WORDEN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF248880)

AF function - communications, surveillance, detection, tracking. Deficiency - inability to obtain high angular resolution imaging detail through the earth's atmosphere. Objective - to develop instrumental and computational techniques to be used for recovering the highest possible angular resolution images of deep space objects when observed through the earth's atmosphere. The application of this technique to recovering the highest possible resolution images of earth orbital satellites and the determination of the limitations and requirements for reconstructing such images, particularly the determination of limiting brightness. Determination of design constraints on ground-based optical telescopes to be used for image reconstruction work. How research contributes -improves Air Force surveillance and identification capabilities on earth orbital satellites by up to a factor of fifty.

A high-quality instrument is to be constructed by the University of Arizona which will be used to obtain the short exposure (speckle interferometry) photographs which are used in image reconstruction work. This system will be designed so as to obtain the maximum possible signal-to-noise and data acquisition efficiency, since a key limitation to image reconstruction work is placed by the ability to acquire information on fainter objects such as satellites. This system will be used to acquire data from which the fundamental limitations to image reconstruction capabilities may be obtained. The specific parameters to be studied are the isoplanatic patch size, spectral bandpasses needed, exposures times and limiting magnitudes - computer software to institute the general purpose Knox-Thompson image reconstruction scheme will be developed - using smaller telescopes, studies will be begun on the feasibility of using large multiple minor telescopes for image reconstruction work - using the speckle camera which is to be built, data on satellites and resolved stellar objects will be obtained from which reconstructed high-resolution images will be produced.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, OPTICAL DENSITY MEASUREMENTS

O. SHEPHERD, Visidyne Incorporated, *Burlington, Massachusetts* (DF247140; F19628-76-C-0253)

AF function - low-altitude operational satellites, airborne surveillance, ballistic nuclear weapon delivery. Deficiency -inaccuracies of AF predictive capabilities of missile trajectories and satellite ephemerides due to lack of density data at critical altitudes. Objective - development and test of remote sounding technique using laser propagation and scattering technology for measurement of atmospheric density in the lower thermosphere. How research contributes - laser experiment will provide measurements of atmospheric density over the critical altitude region from 80 - 160 km.

Develop, fabricate and test laser rocket sounding experiment to be flown to determine the accuracy, range and reliability of the technique for use in remote sounding applications for the measurement of atmospheric density.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, DYNAMICS AND EVALUATION OF GULF STREAM MEANDERS

A.R. ROBINSON, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (NSG 5228)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0029, ANALYSIS OF STRATOSPHERIC TURBULENCE MEASURED BY RADAR

R.K. CRANE, Environmental Res. & Tec. Inc., *Concord, Massachusetts* 01742 (DF248170; F19628-77-C-0059)

AF function - environmental impact statements of high-altitude Air Force operations. Deficiency - current or anticipated AF operations in the stratosphere may deposit harmful material and it is important to be able to assess the dispersion and residence time of such material in the stratosphere. In addition it is anticipated that the dynamics of the stratosphere will be important in the future use of stratospheric chaff for ECM purposes. Objective - develop an experimental time history of the evolution of radar measured stratospheric turbulence, coupled with an analysis of simultaneously obtained radiosonde data for estimates of eddy diffusion rates and eddy diffusivity. How work contributes - the AFGL model for vertical transport of pollutants out of the stratosphere by turbulence is based on the assumption that the turbulent layers form and decay randomly in time and randomly in space. This work provides the data base to test this hypothesis. In addition, this work will provide an independent estimate of the effects of turbulence on vertical transport based on radiosonde data. This work, which relates to the effects of stratospheric turbulence, is relevant also to the effect of winds on chaff dispersion.

Turbulent structure in the stratosphere can be detected by radars of sufficient power and sensitivity. This remote sensing technique permits continuous monitoring of the stratosphere and the growth and decay of turbulent layers. Existing data covers several hours of continuous monitoring for each observation and with many observations for various seasonal conditions. Also available are concurrent radiosonde measurements. Analysis and interpretation of the radar and radiosonde data will provide information on the growth and decay rates and the horizontal extent of horizontal turbulent layers, estimate of energy dissipation rates and eddy diffusion coefficients. The data will be applied to experimentally verify a model which estimates vertical transport rates. This will assist in the determination of the residence time for pollutants deposited in the stratosphere by Air Force operations. It will also give temporal and structural information relevant to chaff dispersion at high altitudes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, CLOUD EFFECTS ON MM WAVES

M.G. FOWLER, Environmental Res. & Tec. Inc., *Concord, Massachusetts* 01742 (DF902520; F19628-77-C-0119)

The objective of this effort is to create an algorithm which will correct for the effects of non-precipitating clouds on millimeter wave emission measurements of the atmosphere. Emission measurements will be used to provide data to a refraction correction system used with precision tracking systems. The refraction correction system requires cloud-free emission data which is generally not available. The algorithm created as a result of this contract will take cloud-contaminated data at three frequencies and output one or two emission data points which are the equivalent of a cloud-free emission measurement.

The approach is threefold. First, accurate and complete atmospheric and cloud models for the regions of interest must be available to act as input to the simulation programs. The cloud models must include cloud cover, cloud type and number of layers. Second, the simulation programs input the atmospheric and cloud data and output accurate emission data with and without cloud effects. Third, a statistical inversion program inputs the emission data and outputs the coefficients for the correction algorithm. To complete the effort, an error analysis will be conducted.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

5.0031, DESIGN AND DEVELOP SPACE VEHICLE EXPERIMENTS

F. RICH, Regis College, Undergraduate School, *Weston, Massachusetts* 02193 (DF249550; F19628-77-C-0122)

AF function - surveillance, communication, navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of satellite environment interactions and ionosphere-

magnetosphere electrical properties for operational needs of AF systems. Objective -design rocket, satellite and shuttle experiments for the study of plasma motions, electric fields, electron hole generation, irregularities and high-latitude current systems. How research contributes - improves Air Force space vehicle reliability and survivability, provides data essential for the design and high performance of communication, guidance and surveillance systems under normal and disturbed conditions. Contributes to the development of Air Force operational ionosphere prediction programs and to the solution of spacecraft charging problems.

Design and develop solution rocket, satellite and shuttle experiments for the study of dynamical processes in the ionosphere and magnetosphere, space vehical-environment interactions, generation and monitoring of atmospheric perturbations. Analyze and synthesize space flight results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0032, THEORY OF STRONG TURBULENCE BY RENORMALIZATION INTO REPEATED-CASCADE
C.M. TCHEN, City University of New York, Graduate School, *New York, New York* 10031 (NSG 1485)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0033, REMOTE SPECTRAL ANALYSIS OF MINERAL-INDUCED PLANT STRESS USING AIRBORNE TECHNIQUES
J.T. JUO, Columbia University, School of Mines, *New York, New York* 10027 (NSG 5222)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0034, ORIGIN AND LIFE CYCLE OF TORNADO CYCLONES
J. MCCARTHY, Univ. of Oklahoma, School of Arts & Sciences, *Norman, Oklahoma* 73069 (ATM74-03400 A03)

This research will study the origin and life cycle of tornado cyclones in Oklahoma and observed by the National Severe Storms Laboratory and the University of Chicago and University of Illinois (NSSL/CHILL) triple Doppler radar system, using a chaff distributing aircraft. A complementary study is proposed by the University of Wyoming to obtain physical and dynamical measurements of the environment of the storms using an instrumented airplane. It will continue tornado life-cycle analyses with data obtained under a predecessor grant (NSF GA-41844). These included the life cycle of two tornado cyclones occurring in 1974 using the Wyoming Queen Air, chaff dispersal, and the NSSL dual Doppler Radar System. In one case (8 June 74, Harrah storm) a tornado was observed to occur. The new field program with NSSL and Wyoming is aimed at further understanding of the genesis mechanisms and evolution of tornado cyclones. Two one-month field efforts are planned during 1976 and 1977, respectively.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0035, DEVELOPMENT OF IMPROVED TELEMETRY AND TRAJECTORY SYSTEMS FOR SOUNDING ROCKET APPLICATIONS
R.F. BUCK, Okla. St. Univ., Graduate School, *Stillwater, Oklahoma* 74075 (DF243160; F19628-75-C-0084)

AF function - command, control and communications. Deficiency -reduced effectiveness of systems for acquiring reliable telemetry and trajectory data from R&D research probes and for exercising command and control over these vehicles. Objective - to develop improved telemetry systems and to provide trajectory data through the TM system. How research contributes - the development of improved telemetry and trajectory systems will increase the effectiveness of instrumentation systems used to support AF R&D rocket and satellite programs. Design and development will be based on specific type of research vehicle to be instrumented and the range from which the rocket is to be launched. The trajectory through telemetry system will enable programs to be launched from remote sites to coincide with geophysical events. Improved reliability of systems for telemetry data transmission, trajectory determination, vehicle command and control, or other electromagnetic transmission and reception applications will be the final objective of this work.

Define exact technical specifications and requirements for electrical and mechanical design of the electronic support instrumentation package for each research rocket. Utilize extensively existing designs with features developed previously for similar purposes and for which existing blueprints can be used. Development of the lightweight portable tracking through telemetry (TRATEL) system will include examination of the trade-offs possible in relaxing somewhat the criteria which determine the current characteristics of the TRATEL I and II systems in the interest of reduction in physical size and weight, complexity and sophistication, and ease of field operation and maintenance. Details of an associated ranging capability will be dependent upon the PCM data recording system presently being developed for the larger existing systems, for compatibility with chosen airborne elements and common ground support equipment must be maintained. The basic approach is to first complete a study of the acceptable performance criteria. Following this study phase, build-up of preliminary design elements will be used to verify the predicted performance of the simplified system relative to the larger existing systems by a direct comparison and/or interchange of components. Evaluation of the performance achieved will then permit construction of a prototype system. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0036, STUDY & DESIGN AN ATMOSPHERIC ION ANALYZER
M.W. SIEGEL, Extranuclear Laboratories Inc., *Pittsburgh, Pennsylvania* (DF248860; F19628-77-C-0183)

AF function - military operations of the B-1, F-15 and other vehicles in the stratosphere. Deficiency - the environmental effects of AF stratospheric operations cannot be predicted because of a lack of knowledge of the normal species concentrations and their spatial and temporal variations. Further, the mixing properties and chemical interactions of jet engine or missile effluents are only poorly defined. Objective - develop sampling and analysis instrumentation, methods, and techniques to determine the ionic composition and electrochemistry of the stratosphere, and conduct an initial measurements effort.

A theoretical and experimental study will be made of the problems of sampling and analyzing positive and negative ions in the stratosphere with balloon-borne instrumentation. Sampling and analysis instrumentation will be designed, built, tested and modified as necessary to implement a balloon-borne experiment. How research contributes - ions may be effective sinks for pollutants by serving as condensation nuclei which could agglomerate stratospheric pollutants, forming aerosols which subsequently fall from the stratosphere into the troposphere where they are washed out. Consequently, instrumentation and techniques developed for stratospheric positive and negative ion measurements are essential to elucidate nucleation processes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0037, STUDY OF THE IONOSPHERE USING TRANSMISSIONS FROM RADIATING SATELLITES
S.J. CARDUS, Ebro Observatory, *Tortosa, Spain* (DF258020; AFAFOSR-2745-75)

AF function - navigation. Deficiency - refraction and pulse delay errors. Research - measures ionospheric parameters related to solar activity. How research contributes - results combined to construct TEC model used in calibration of global navigation systems in the European sector. This work continues TEC observation using INTELSAT II F3 and data reduction in the Joint Satellite Studies Group format. Objective -to determine destructive effects of travelling ionospheric disturbances on radio and radar signals.

Using a vhf polarimeter supplied by AFCRL, the grantee will observe Faraday rotation in the ionosphere in order to derive total electron content values on a continuous basis. These reduced data will be supplied to AFCRL in standard format, in addition to furnishing the basis of the grantee's own scientific analyses and reports.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0038, NAVY ENVIRONMENT - RADIANCE AND POLARIZATION OF LIGHT IN THE OCEAN
G.N. PLASS, Texas A & M University System, School of Geosciences, *College Station, Texas* 77843 (DN123231; N00014-75-C-0537)

Optical systems designed for remote sensing and surveillance, submarine detection and communication, search recovery operations, and sea floor inspection requirements are all critically dependent on a thorough understanding of the optical properties of sea water and the nature of the background illumination in the ocean. This task will examine and model the radiance and polarization of light in the ocean.

Monte Carlo and matrix operator techniques are used to calculate theoretical models of photon interactions from natural sunlight and artificial sources for coupled atmosphere-ocean systems. Scattering and absorption by aerosols, hydrosols, atmospheric and water molecules; reflection and refraction at the atmosphere-water surface; surface wave effects; and polarization effect are all included in the numerical models. These calculations predict the effect of wavelength solar angle, hydrosol size, and ocean waves on the distribution of the intensity and polarization of light in the ocean.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0039, DEVELOPING NEW TECHNIQUES TO SURVEY CHEMICAL VARIATIONS IN COASTAL WATERS
D.R. SCHINK, Texas A & M University System, School of Geosciences, *College Station, Texas* 77843 (R/OP-4)

OBJECTIVES: To develop and demonstrate a new method for exploring the variability in the composition of coastal marine waters. The method involves deployment of a towed pumping system from a ship underway, and sampling from depths of between 175 meters and the surface. The water is delivered to a set of automated analytical systems for nutrient, hydrocarbon, pH and oxygen determination. The analytical data is automatically transmitted to a shipboard computer for storage, reduction and preliminary evaluation. Operation of such a system would allow surveys of large areas of the coastal zone to be accomplished within relatively short periods of time.

ANTICIPATED BENEFITS: Those involved in fisheries, resource development and environmental protection will ultimately benefit from the instrumentation developed by this project. The development and utilization of a towed, deep pumping system coupled with an automated analytical unit will help demonstrate the feasibility of using hydrocarbon detection in coastal waters as another tool in the search for offshore oil and gas. This device might also provide the most efficient monitor for gaseous hydrocarbons and other pollutants which escape into the sea as a result of various coastal and offshore activities by man.

This system can be used to survey various chemical patterns in the ocean and should lead to a new appreciation of the role various oceanographic processes play in nutrient salinity, pH and oxygen distributions in coastal waters.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0040, NAVY ENVIRONMENT - BALLOON CLOUD PROBES
A.A. FEW, Rice University, Graduate School, *Houston, Texas* 77001 (DN123363; N00014-75-C-0139)

To apply modern balloon technology to the probing of maritime clouds in order to support naval operations through a better comprehension of atmospheric phenomena.

Balloons of special construction will be prepared with sensing equipment and telemetry contained within the balloon. The balloon surface will also be used for sensing. The balloons will be released as free balloons into clouds and be supplemented and compared with standard radio sounding techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0041, ATMOS SPACELAB I SCIENCE INVESTIGATION
J.H. PARK, Coll. of William & Mary, School of Arts & Sciences, *Williamsburg, Virginia* 23185 (NSG 1484)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0042, SHEAR FLOW EFFECTS IN CONSTANT DENSITY AND STRATIFIED FLUIDS
W.O. CRIMINALE, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (DF019810; AF-AFOSR-2579-74)

AF function - advanced aerospace vehicles. Opportunity - gain a better understanding of the underlying concepts of fluctuations in the atmosphere. Objective - develop analytical and numerical methods to study origins of turbulence, energy transfer, fluctuations and structure of the atmosphere and its boundary layer. How work contributes -improvement in understanding of atmospheric structure and fluctuations will permit better design of aerospace vehicles in which these factors could be limiting or controlling factors.

Analytical and numerical methods will be used to study linear models that deal with origins of turbulence and energy transfer in a stratified medium and fluctuations and structure within the atmospheric boundary layer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0043, RESEARCH OF THE EFFECT OF SYNOPTIC SCALE PROCESSES IN GLOBAL CIRCULATION MODELLING
G.F. HERMAN, Univ. of Wisconsin, Space Science & Engr. Center, *Madison, Wisconsin* 53706 (NSG 5223)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, DEVELOPMENT OF ASUPT AS A CRITERION SYSTEM
T.H. GRAY, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF222100)

The objectives of this study are: to verify the 'performance equivalence' methodology as a useful technique for establishing simulator fidelity, and to establish ASUPT as a criterion system for training research.

An identical flight profile using the same experienced pilot will be flown in ASUPT and T-37 instrumented aircraft 948. This procedure will be replicated with five pilots. Measures of pilot and system outputs will be taken using performance measurement concepts discussed in WAAG 1974. These measures will be analyzed by a linear model to produce pilot equations that will then be used in computer simulations to determine ASUPT and aircraft comparability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, F4 SYLLABUS OPTIMIZATION STUDY
L.D. POHLMANN, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223540)

To quantify differences in pilot student performance which result from instruction according to two Tactical Air Command (TAC) syllabi--one optimized to train air-to-air (a/a) combat tasks, and the other optimized to train air-to-surface (a/s) weapons delivery tasks.

The performance of three groups of recent graduates of initial f-4 combat crew training (RTU, B-course) in both a/a and a/s tasks will be compared. One of these classes will receive normal RTU training in which a/a and a/s are about equally emphasized. The other two classes will receive specialized training, one class according to a syllabus emphasizing a/a tasks and the other according to a syllabus emphasizing a/s tasks. For both classes, a reduced amount of training will be given in the non-specialized area. Performance of the three groups of aircrews will be evaluated during five to six aircraft sorties. These data will be augmented by data from simulation devices. Data for a/s tasks will also be collected on the advanced simulator for pilot training (ASPT), for a/a tasks on the simulator for air-to-air combat (SAAC), and for both kinds of tasks on the automated adaptive flight training system (AAFTS).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, ADVANCED SIMULATION IN UNDERGRADUATE PILOT TRAINING UTILIZATION
J.F. SMITH, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF220510)

Through continuing review and compilation of relevant research results and analysis of available equipment capabilities, to formulate and implement an integrated division research program which will maximize contributions to the simulator usage data bank through most efficient use of available resources.

Research issues relevant to increased acceptance and use of simulation will be identified and prioritized. Capabilities of available equipment will be analyzed and research issued which may be addressed with each device will be identified. Specific projects will then be designed and conducted to provide empirically derived data on relevant research issues. These projects will investigate such variables as motion computational techniques and excursion requirements, visual scene content, field of view and brightness, etc., all in terms of their effect on increased training efficiency.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, AUDITORY AND VISUAL INFORMATION PROCESSING
S.R. PARKINSON, Arizona State University, School of Liberal Arts, *Tempe, Arizona* 85281 (DF223170; F33615-77-C-0053)

To investigate the information processing involved in instrument cross-check skills and task load stress.

An analysis of differences in visual scanning strategies employed by students and instructor pilots will be conducted. Visual scanning will be evaluated by both classical behavioral measures and film records of eye focus points. Task load problems will also be investigated. This research will be conducted in four phases: (1) The first phase will evaluate the effects of different amounts of exposure (using visual scanning tasks) on instrument displays measuring cross-checking capability. This phase should determine the amount of exposure which will result in maximum improvement in performance. (2) The second phase will examine critical features on instrument displays to see if presenting to trainees a variety of instrument displays early in training will facilitate more efficient critical feature analysis. The Ss will also be presented with novel aircraft displays to determine if this training procedure will enhance ability to learn efficient scanning strategies. (3) The third phase will employ a central light display with dynamic scanning requirements similar to those of the flight task. Response latency measures will be taken on both pilots and non-pilots to compare differences in use of the information obtained from the central light display. Response latencies for IPs and trainees on cued trials will also be compared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0005, EXCITATION OF A WIRE IN A RECTANGULAR CAVITY
C.M. BUTLER, Univ. of Arizona, School of Medicine, *Tucson, Arizona* 85721 (DF043740; AF-AFOSR-3009-76)

AF function - this research will address the problem of a wire inside a cavity excited by an impressed electric field in an aperture in the cavity wall. The current induced on the wire and the field within the cavity are to be determined. This problem is an idealization of a wire in some metal enclosure which may be part of an Air Force system. This work is an important part of the analytical efforts in the AF EMP assessment program directed by the AFWL. Opportunity - by performing a careful investigation of the ideal wire/cavity problem, it should be possible to establish the theory and obtain characteristic data needed to provide a foundation for predicting the electromagnetic response of the wire and the region within the enclosure of a practical system. Objective - to determine the susceptibility of a wire inside a cavity system to electromagnetic pulse (EMP) excitation. Contributions - this work will develop the theory and solution technique and representative data which provide a preliminary characterization of the electromagnetic response of the wire/cavity system. The final computer program will be provided to the AFWL for use on aircraft EMP assessment problems.

The assumptions and conditions of the wire/cavity problem to be investigated are - (1) the cavity is the interior region of a perfectly conducting rectangular box, (2) the material inside the box is uniform, linear and isotropic, (3) the cavity is excited through a small hole (aperture) in the wall of the box. The hole may be located on any wall and the electric field in the aperture is specified, (4) the wire is circular and perfectly conducting and it is oriented with its axis perpendicular to a side wall of the box, (5) the wire may be loaded, uniformly and/or lumped loaded, and its ends may or may not be in electrical contact with the side walls to which the wire is perpendicular, (6) the wire is thin at the frequency of operation and thin wire assumptions will be utilized, and (7) all calculations are to be performed in the frequency (time-harmonic) domain, but with a few typical inverse Fourier transforms attempted as a goal.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0006, NEUROPHARMACOLOGICAL EVALUATION OF TOXIC CHEMICALS
M.B. STERMAN, Univ. of California, School of Medicine, *Los Angeles, California* 90024 (DF319630; F33615-76-C-5014)

The 6570 AMRL has been investigating the pharmacological and toxicological effects of certain missile propellants in order to more safely use such compounds in a manner dictated by good industrial hygiene and industrial medical practice. In order to set standards for exposure criteria and to determine methods for combating the effects of those propellants and chemicals in exposed individuals, it is necessary to determine the exact mode of action of the agents on specific body function. The specific objective is to study the effects of hazardous chemicals of interest to the USAF on behavior responses in laboratory animals, obtain data on performance, correlate behavior changes with other neurological events, and test the efficacy of therapeutic measures to abort untoward effects of the agents.

A study will be conducted to advance the state-of-the-art with respect to the central nervous system effects of toxic chemical compounds of interest to the USAF. Previous studies in this regard have been performed using the cat as the primary model. Research with the cat has indicated a need to change the primary model to a primate for comparative purposes. It is now evident that certain forms of chemically induced epileptic manifestations are better studied in the primate. The specific agent to be studied using primate models will be the propellant, methylhydrazine. The data will be utilized to study mechanisms of action of the compound as well as various therapeutic regimens necessary to abort toxic manifestations. The data will also help develop toxicity criteria for the USAF as required by AFR 19-1.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0007, EFFECT OF SPACE FLIGHT AS SIMULATED BY BED REST ON DRUG DISPOSITION
D.C. HARRISON, Stanford University, School of Medicine, *Palo Alto, California* 94305 (NSG 2294)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0008, MODELING THE EFFECTS OF ACCELERATION STRESS ON HUMAN OPERATOR PERFORMANCE IN AN AIR-TO-AIR TRACKING TASK
K. KESSLER, Systems Control Incorporated, *Palo Alto, California* 94306 (DF320780; F33615-77-C-0507)

A division requirement exists for a model of the human pilot tracking on a one-on-one, air-to-air engagement. Of particular interest is that the model reflect the effect of linear acceleration (g) and the effect of seat tilt back angle on the human tracker. TAC Avenger is a widely used air-to-air engagement model used by several Air Force organizations. It incorporates pilot decision logic to execute standard fighter tactics and determine realistic maneuvering flight paths. When the pilot decision logic establishes that one aircraft is in a missle launch or gun firing position against the other, the kill probability is computed by a separate appropriate subroutine. This subroutine, which is more detailed, can propagate the pilot tracking mean and covariance through the rest of the aircraft system, ballistics, and fly-out to establish the probability of kill for each gun firing opportunity. This contract will be to develop and validate a human tracking model with which to modify the TAC Avenger tracking subroutine and answer the requirement for a TAC Avenger modification which reflects the effect of cumulative g loads on the pilot and the effect of seat back angle.

With the data produced by a series of experiments on the dynamic environment simulator (DES) conducted by AMRL, the contractor will develop and validate a human tracking model responsive to the influences of g and seat back angles. The contractor will be involved in the discussions preceding an experiment in order to assure that the data produced by the experiment will be optimally useful for the modeling requirements. It is anticipated that there will be one or two experiments conducted and that each of the experiments will, in part, capture human tracking performance under g, with the influence of various seat back angles included. The output of the model will be the mean and covariance of the pilot tracking error as a function of seat tilt back angle (with respect to the g vector), the present g load factor, and the antecedent g load factor. This is the mathematical form that can be most easily incorporated into TAC Avenger. The product of this task will be the mathematical description including all of the initial conditions and parameter values which describe the human tracker in this experimental situation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0009, WIDE-ANGLE, MULTI-VIEWER INFINITY DISPLAY STUDY
L. SCHAFFER, General Electric Company, *Daytona Beach, Florida* 32015 (DF229100; F33615-76-C-0064)

To develop a design for a wide-angle, multi-viewer infinity display system for use in visual simulation. Current multi-viewer display systems provide a relatively narrow field-of-view. State-of-the-art wide-angle displays are limited to only one viewer. With this study, the technology to provide a continuous wide-angle, color infinity image to the cockpit crew in a flight simulator will be investigated. A display system based on this initial design study is intended to increase the number of missions which can be trained in simulators for bomber, cargo, and tanker-type aircraft and will provide more effective training.

Representative visual simulation display requirements for bomber, tanker, and cargo-type aircraft have been developed. Those requirements include viewing for all crew members requiring visual contact with the terrain, provisions for mounting on a motion platform, image quality parameters, and color television type input. Using these requirements, this study effort will develop a design definition and will describe any technical areas which require further research. This study will review current technologies and explore near-future technologies for the basis of selecting a display technique. The main study area will be the optical design of the display system and the feasibility of manufacturing these optical devices. Other areas of study include interfacing the display system with the motion platform, simulator cockpit, and the television image input device. It is anticipated that this study will result in a paper-design and that additional development will be required before this design can be implemented in hardware.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0010, LONGITUDINAL FOLLOW-UP STUDY OF THE PHYSICAL STATUS OF 1000 NAVAL AVIATORS
R.E. MITCHELL, U.S. Navy, Aviation Medicine Division, *Pensacola, Florida* 32512 (DN540719)

To provide data from the 1000 aviator study which will allow the establishment of more physical standards for aviation and to provide methods of early prediction of alterable or preventable conditions with the ultimate goal of extending the useful life of the naval aviator.

A unique study of aging in a pilot population, consisting of naval aviators, was started in 1940. Subsequent to the initial examinations the members of the group were reexamined in 1952, 1958, 1964, and 1969, the data from each reassessment contributing to a three-decade study, the longest study ever made on a pilot population.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab.

6.0011, BLUE-GREEN ALGAE STUDIES
UNKNOWN, Southern Illinois University, Graduate School, *Carbondale, Illinois* 62901 (NSG 7394)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0012, DIVIDED ATTENTION AND TASK WORKLOAD IN CONTROL FAILURE DETECTION AND DECISION-MAKING IN AVIATION SYSTEMS
C.D. WICKENS, Univ. of Illinois, School of Liberal Arts & Sci., *Urbana, Illinois* 61801 (DF049320; AF-AFOSR-3380-77)

AF function - the role of attentional processes in flight control has assumed an increasingly important position in aviation and man-machine systems research because of increased complexity of weapon systems and aircraft missions. Deficiency - accordingly, it is critical to better define the pilot's attention capacities and limitations for purposes of enhancing the probability of mission effectiveness. Objective - attention allocation processes as they affect pilot operator performance under varying task loads and in relation to monitoring vs. control functions will be modeled to elucidate understanding of the interrelationships. How research contributes - a major contribution of the proposed research to real-world aviation problems is anticipated to be the provision of a theoretical basis for predicting the consequences of adding different operator requirements in the design of new systems.

Employing a latency-based theory of signal detection, the research will model the operator's performance in detecting and responding to changes (failures) in the dynamics of simulated aircraft systems. Performance as a function of operator monitoring vs. operator controlling functions will be examined, and conclusions will be drawn concerning the appropriateness of one mode vs. the other. Also, the effects of divided attention on tracking performance using control theory analysis will be investigated and an attempt will be made to model the dynamic characteristics of attention allocation as the operator is required to respond to increasing or decreasing task demands in the dual task environment. Application of the results will be explored concerning (1)

on-line monitoring of attention, and (2) attention allocation ability as a predictor of flight training success.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0013, RESPONSE OF THE CARDIOVASCULAR SYSTEM TO VIBRATION AND COMBINED STRESSES
C.F. KNAPP, Univ. of Kentucky, School of Engineering, *Lexington, Kentucky* 40506 (DF037240; F44620-74-C-0012)

AF function - high level of performance is demanded of aircrew members during operation of aerospace systems. Environmental stresses such as acceleration may severely compromise this performance. Deficiency - circulation is a major body system which may be extended to critical limits since it is directly affected by acceleration and is indirectly involved in all adjustment of the body to environmental stress. There is a critical lack of information on the function of this system in relation to the extreme environmental conditions. Objective -the ability to classify and evaluate meaningful risk factors related to these stresses is contingent upon a thorough understanding of the involved physiological mechanisms. These studies are an attempt to elucidate the mechanisms responsible for cardiovascular changes in animals exposed to low- and high-frequency acceleration. How research contributes - the ultimate aim is to provide the background required for design of human investigations leading to improved protective equipment and operational procedures and is in support of subarea 1.6 'mechanical forces'.

This project integrates advanced analytical techniques and instrumentation development capabilities of a team of biomedical engineers and physiologists using chronically instrumented animals as surrogates for the human.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0014, HEALTH CHANGES IN AIR TRAFFIC CONTROLLERS
UNKNOWN, Boston University, Graduate School, *Boston, Massachusetts* 02215 (FA38619; FA73WA-3211)

Biomedical research study for the purpose of determining the kinds and degree of health changes occurring in air traffic controllers, and the causes of such changes.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

6.0015, GENERAL AVIATION PILOT TRAINING IMPROVEMENTS
UNKNOWN, Aerospace Systems Incorporated, *Burlington, Massachusetts* 01803 (FA77WA-4014; FA160414 (TRAIS NO.))

The purpose of this contract is as follows: (1) The number of subjects from which complete data is gathered, after normal attrition, in each experimental and control group shall be a minimum of 40; (2) The control group, as well as the experimental group, shall be populated by volunteers for the complete experimental syllabus; and (3) Flight instructors assigned to conduct the experimental syllabus shall not concurrently instruct students in the control syllabus.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

6.0016, QUANTIFICATION OF IN-FLIGHT FATIGUE
P.H. ABBRECHT, Univ. of Michigan, School of Medicine, *Ann Arbor, Michigan* 48104 (DF320310; F33615-76-C-0607)

This effort will provide a detection and assessment scheme for induced respiratory fatigue, and enable subsequent inference and prediction of systemic response. This latter provision will ensure a quantitative evaluation capability for environmental testing of life support items as well as contributing design guidelines for the same.

The contractor is required to derive a methodology for quantitating the phenomenon of fatigue with particular consideration of respiratory fatigue as it occurs in flight. Because fatigue is necessarily reported subjectively by the individual, objective physiologic measures must be accompanied by a subject reporting scheme. The combination of physiologic measurements and sensation reporting will then be summarized in a form enabling accurate recognition and prediction of respiratory fatigue levels. This effort should be accomplished with the following sequence- (1) identification and evaluation of the most valuable noninvasive indicators of respiratory fatigue resulting from breathing resistances or their equivalent - in the laboratory setting inflight circumstances must be necessarily be approximated with treadmill exercise, ergometry, or equivalent, (2) development of an accurate method for subject reporting of fatigue on a timed interval basis, (3) determination of simple relationship between respiratory fatigue levels and easily measured functions such as spirometry, pneumotachography, or combined heart/lung function. Ultimately a recommendation is sought for the recognition of respiratory fatigue and its consequences via short-term noninvasive monitoring.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0017, DYNAMIC CHARACTERISTICS OF HUMAN MOTOR PERFORMANCE IN CONTROL SYSTEMS
C. TERZUOLO, Univ. of Minnesota, School of Medicine, *Minneapolis, Minnesota* 55455 (DF040490; AF-AFOSR-2804-75)

AF function - in the design of control systems for aircraft and in other situations where a human operator is involved, it is necessary to know in precise terms the motor characteristics of man's muscular capabilities expressed in the mathematical language of the control system engineer. Deficiency - such data for man are incomplete. No fully adequate predictive model of man's movements is available. Research -this group is developing a model of human motor control with the aid of computers based on neurophysiological experiments. The model will incorporate nonlinearities known to exist in the human central nervous system. How contributes - the results will be in terms directly useful to engineers designing aircraft controls or other humanly activated controls in Air Force equipment and are applicable to AFSC RO 1.8.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0018, PROJECT 5973 SUPPORT
J.H. BRINDLE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321190)

This work unit will continue to support project 5973, development of visually coupled aids, with technical support following transition of the engineering development program to ASD/AE. This support, in accordance with transition guidelines, will include both technical and human factors inputs to the hardware development as well as the test and evaluation phases of the program. Through such inputs the program will be provided with necessary technological advances, performance measures on candidate VCS subsystems, and interface criteria for VCS components in various applications testing. This effort supports AFSC development goals TC-2, TC-4, TC-5, TC-7, and MS-4, and PMDR-P2033(5)/64708F/5973, visual coupling aids.

Promising VCS component technology will be developed to the point where it can be incorporated into the 6.4 program in ASD/AE. Technical and human factors inputs will be provided to test efforts such as single seat attack (SSA), visual aided tracking system (VATS) and project Quick Strike. This includes support for both ground-based simulation as well as flight testing. Measurement data on various VCS component capabilities will be provided using the image metric laboratory and, in some cases, final acceptance testing of deliverable systems will be performed. Helmet integration of VCS components will be pursued and basic helmet development and interface work will be applied where appropriate. Methodology for providing an efficient, timely flight test support capability will be evolved and coordinated with ASD/AE on a regular basis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs

6.0019, CREW SAFETY REQUIREMENTS AND EVALUATION CRITERIA FOR B-1 ESCAPE SYSTEMS

J.W. BRINKLEY, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322770)

The first three B-1 prototypes incorporate a crew module escape system; however, due to high life cycle costs and technical problems the crew module escape system was abandoned for future production aircraft. Emergency escape will be provided by four ejection seats for primary crewmembers and an escape hatch for instructor aircrew. The objective of this effort is to provide aeromedical consultation on the degree of crew protection provided by the ejection seats.

Technical support will be provided during the preparation of computer programs required to process acceleration data recorded during the ejection seat qualification program. The processed data from these tests will be analyzed by this office as required by the B-1 System Program Office. Biomechanical criteria for an analysis of the effectiveness of the ejection seat trajectory divergence system will be provided within the limits of the existing biotechnology. Aerodynamic data obtained from the contract effort documented under work unit 72310648 will be provided to the B-1 SPO as it becomes available. These data will quantify the parameters necessary to determine influence of the aerodynamic properties of the human body and the influence of the body position on trajectory divergence and escape system stability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0020, SELF-ORGANIZING CONTROL-RPV AUGMENTATION

M.W. CANNON, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF316990)

The goals of this study are: 1) to determine the effectiveness and appropriate utilization of a self-organizing controller in the RPV mission, 2) to establish minimum data rate transfer to the operator with and without SOC augmentation, 3) to investigate more efficient logic configurations and alternative methods of parameter search algorithms to improve SOC.

The study is divided into six phases of RPV simulation. In phase I, man's tracking ability will be evaluated with and without SOC in the absence of video information. Phase II, various controllers, i.e., bang-bang, proportional, adaptive (SOC), will be compared during the terminal attack (tracking) in the absence of video information. Phase III will repeat phase II experiments with maximum video information available to the controller. In phase IV, video information will be degraded and frame rate reduced, the operator's performance with the various controller will be measured. Phase V will examine operator's performance with and without augmentation controls during ECM jamming. The final phase, phase VI, will combine reduced video transmission, reduced frame rate, and jamming in order to quantify the utility of SOC in terms of the RPV operator's performance when the attack phase is hampered by reduced and degraded video information.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0021, EFFECTS OF ACCELERATION INDUCED CARDIOPULMONARY FUNCTION ON HUMAN OPERATOR PERFORMANCE

W. INGE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322430)

To measure the effect of gz acceleration on cardiopulmonary function and the impact of this stress-response interaction on human operator performance. The need exists to describe and optimize physiologically drive performance parameters for Air Force operations. This technology will define those physiological criteria which contribute to the optimization of human performance.

The effects of acceleration on cardiac output, regional blood flow and rheological changes will be delineated in the instrumental animal. Relevant findings in these areas of research will direct subsequent studies involving performance trained nonhuman subjects. Pulmonary function tests (i.e., lung closing volumes) accomplished on human subjects may offer a data base which can be correlated with, and predictive of, human operator performance decrements under the stress of high g environments. These performance decrements will be determined either by using air combat simulation on the AMRL dynamic environmental simulator or by conventional performance measurement techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0022, FAILURE CHARACTERISTICS OF SPINAL ELEMENTS

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Spinal injury continues to be a problem associated with ejection from USAF aircraft. This investigation is being carried out in two phases in order to provide a qualitative and quantitative basis for modeling actual operational vertebral injuries. The initial phase of this investigation deals with the identification and classification of spinal injuries. The second phase is an experimental investigation to provide for the first time quantitative data on the nature of the local response of spinal vertebrae to complex mechanical loads and formulation of clinical methodology for recognition of these spinal injury patterns.

Results of past and present studies on spinal impact loading experiments will be scrutinized to identify mechanisms of failure. Similarly, clinical records involving spinal injuries will be studied to examine the structural mechanisms of the particular types of injuries identified. Additional experiments will examine the isolated vertebral centra under compressive loading at three different strain rates. The results of this effort will assist the formulation of a new mathematical model under RTE 3-H-3 depicting the structural, mechanical and material property response of isolated vertebral elements encompassing their rate-dependent and nonlinear characteristics. These data will also provide a quantitative basis for increasing allowable load transfer levels to man by impact loading during ejection from aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0023, IMAGE DISPLAY METRICIZATION

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The objective of this work unit is to develop, refine and validate display measures and techniques which are relatable to observer performance. This includes cathode ray tube (CRT) displays, liquid crystal displays and light-emitting diode displays used for imagery or symbology purposes.

The image metric laboratory will be utilized to investigate various display measuring procedures. Initial effort will center on CRT displays utilizing imagery producing sources. Later efforts will extend these mensuration techniques to symbology displays and solid-state display devices, i.e., light-emitting diode arrays, liquid crystal matrix displays, etc. The overall capability of the image metrics laboratory will be developed to allow a systematic trade-off of candidate photometric/radiometric mensuration techniques based upon reliability, repeatability and appropriateness of each measure for describing display image quality. Candidate measurement techniques will then be evaluated utilizing psychophysical and electro-physiological studies to ascertain the value of the approach for correlating with operator performance. A specific ongoing effort will continue to evolve a unity image quality metric based upon description of the interaction of human visual moduiation threshold function and the measured modulation transfer function capabilities of the display device. A product of this work unit therefore will consist of validated standardized techniques for assessing imaging display performance which can be used to establish a MIL STD for imaging displays. In addition, the output of this effort is essential for establishing the overall unitary/image quality metric described in RTE-B5 work unit B-display/operator interface and target acquisition prediction model in RTE-D1 work unit B. This work unit supports AFSC development goals TC-1, TC-7, C3-3 and MS-4. This work unit replaces work unit 71841101, image/display quantification.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0024, SCREENING TECHNIQUES
R.D. ODONNELL, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321080)

To develop a graded screening procedure for potential visual countermeasures which will allow increasingly more refined decisions concerning the effectiveness of the countermeasure against anticipated threats. The enormous costs of high fidelity and field simulation require that only proposed countermeasures with a high probability of success be tested in these modes. The ultimate purpose is to add a low-cost series of screening procedures to a systematic evaluation sequence in order to allow larger numbers of countermeasures ideas to be tested, and to cost-effectively evaluate those with the highest probability of success. Supports AFSC development goals SO-5, TC-5, and TC-8.

Traditional and novel measurement techniques will be explored for potential utility in evaluation of countermeasures concepts. Such techniques include classical psychophysical measures, standard laboratory performance metrics, as well as standard and novel psychophysiological evaluations (e.g., visually-evoked responses, eye movement analysis, etc.). In addition, a generalized tracking task containing the highest level of fidelity consistent with a broad range of operator input requirements will be developed under a separate work unit. This tracking task, and other promising measurement techniques developed in the laboratory will be validated against high-fidelity simulation and field tests, and will be sufficiently standardized to become part of assessment battery for potential countermeasures concepts. Integration of these screening procedures with higher fidelity evaluations will provide a systematized process which will allow maximally cost-effective decisions concerning the development of each countermeasure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0025, IMPLEMENTATION OF ANSI SPECIFICATION S3.19-1974, PERSONAL HEARING PROTECTIVE DEVICES FOR USE IN NOISE ENVIRONMENTS
M.R. STEPHENSON, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321310)

AMRL/BBA is responsible for evaluating personal hearing protectors for use in AF hazardous noise environments. Military specification MIL-P-38268A specifies the procedures employed to evaluate hearing protectors, and requires the use of the ANSI real ear attenuation at threshold (REAT) method for the evaluations. The American National Standards Institute (ANSI) has recently revised the standard relevant to the REAT method. To maintain compliance with MIL-P-38268A, it is the objective of this work unit to procure and assemble the items necessary to implement the new measurement instrumentation and test methodology for use under 72310338.

Requirements necessary to implement the new standard will be identified, including specification of the instrumentation needed to generate the test signals and record the subjects' responses. A survey will be made of existing facilities to determine whether modifications of these facilities will be required, as well as to determine possible requirements to procure additional instrumentation. When the necessary equipment is available it will be assembled into an instrument console adjacent to the test room. Completion of this assembly will permit this laboratory to initiate hearing protector evaluations using the ANSI S3.19-1974 standard. Software will be developed to present the data in forms consistent with current methods and standards.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0026, ANALYSIS OF QUESTIONNAIRE DATA ON AIR FORCE TECHNICAL ORDERS
D.L. THOMAS, U.S. Air Force, Human Resources Laboratory, *Dayton, Ohio* 45433 (DF228430)

To identify problem areas with the conventional style technical data used by aircraft maintenance technicians today. The report, resulting from the analysis of questionnaires, will identify strengths and weaknesses of the conventional-style T.O.S. It will provide a solid, factual basis for future research to improve Air Force maintenance technical orders. The report is also expected to provide additional justification for the Air Force decision to provide proceduralized data for new weapon systems.

As part of an earlier project, questionnaires were administered to 248 maintenance technicians. The questionnaire measured the opinions and attitudes of the technicians toward conventional technical orders. The questions are the same as those administered in a 1963 study of the Air Force technical order system. Analysis of the data will provide a means of determining if the problems identified in the earlier study have been resolved and what problems remain. The results of the analysis will be compared with the results of the 1963 study and summarized in a technical report. Data analysis is expected to be complete by 30 June 1977. The technical report will be complete by 30 Sept. 1977.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0027, SUBJECTS FOR HUMAN FACTORS APPLIED RESEARCH
W.J. HOVEY, Univ. of Dayton, Res. Inst., *Dayton, Ohio* 45409 (DF318360; F33615-76-C-0524)

The primary purpose of this contract is to procure the services of student volunteers to serve as experimental subjects in experiments conducted by and for the Human Engineering Division of the 6570 Aerospace Medical Research Laboratory for Human Factors Applied Research. The secondary purpose is to procure professional-technical effort associated with requirements herein specified.

This effort will be involved in experiments to determine human performance capabilities and limitations as they relate to the design of Air Force equipment and systems and to establish design principles and criteria for optimum utilization of human performance capabilities. For example, university students will serve as subjects to determine operator capabilities for controlling remotely piloted vehicles, head switching comparison, voice recognition, joystick evaluation, validation of COMBIMAN, anthropometry of design eye position, test and evaluation of special purpose photogrammetric system, hud symbology criteria, windscreen visibility, etc. These experiments will be conducted at the Human Engineering Divison facilities at Wright-Patterson Air Force Base. Screening and pretesting of subjects will be done by the contractor at the contractor's facility.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0028, USAFSAM CARDIOVASCULAR DISEASE FOLLOW-UP STUDY CLINICAL EVALUATION
R.S. DRYDEN, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF323070)

Provide clinical evaluation in standardized environment to identify the earliest signs of occult or latent coronary artery disease and relate these to the 20 plus years of risk factor data which have been accumulated on this selected population. This information would be assimilated into refined selection and retention criteria for officer candidates in order to select and retain those least likely to suffer from premature cardiovascular disease.

Perform a thorough examination at USAFSAM to evaluate each subject's cardiovascular system and all risk factors, including all applicable medical and laboratory tests. Devote special attention to motivating subjects, both active and inactive, to participate in the study. Collate the data obtained from multivariate analysis of risk factors. Apply the results to the problems of (a) improved selection of candidates for pilot training and (b) early identification of individuals prone to heart disease. This work was previously documented under work units 7930-07-05 and 7755-14-04.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0029, TRAINING TECHNIQUES FOR IMPROVING G TOLERANCE
K.K. GILLINGHAM, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF323600)

To develop methods of improving g tolerance of aircrew through refinements in straining technique, through physical conditioning, and through application of physiologic principles elucidated in previous g-stress research; to develop instructional methods and materials for transmitting to aircrew pertinent information on g-tolerance enhancement technique; to instruct flight surgeons, physiological training officers, and pilots of high-performance fighter aircraft in optimum methods of g-tolerance enhancement.

The USAFSAM human centrifuge will be used in conjunction with films and video recording equipment in VNB to instruct the various trainees in currently accepted g-tolerance-improving techniques, specifically the m-1 and l-1 straining maneuvers. The consequences of inadequate techniques will be observed by the trainees under controlled conditions, and video replay will be used to point out errors in technique. Incorporation of potentially useful modifications of current techniques will be accomplished whenever newly apparent physiologic principles can be translated into such modifications. Evaluation of effectiveness of modified techniques will first be subjected to informal scrutiny, then to formal statistical study if warranted. Assessment of the effects of various forms of physical conditioning on g-tolerance improvement will be continued (previously accomplished under work unit 79301309). Through evolution and consolidation, optimally effective sets of didactic materials, human centrifuge training runs, and physical conditioning recommendations will be developed for use by aircrew flying high-performance fighter aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0030, BIOMEDICAL LIMITS FOR MOLECULAR SIEVE OXYGEN CONCENTRATOR SUBSYSTEMS

K.G. IKELS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322250)

The purpose of this work unit is to determine and define the biomedical limits of the molecular sieve oxygen concentrator subsystem. This effort is necessitated in view of the increased inert gas load in the body caused by the concurrent production of argon by the subsystem at levels 5-10 times that normally found in the atmosphere. This work unit is established to implement a new technology planning objective as directed by HQ Aerospace Medical Division.

A systematic analytical determination will be made at ground level and at various altitudes in order to define the inert gas loads in the body resulting from the wash-in of oxygen-argon mixtures and the wash-out of nitrogen. Particular attention will be addressed to conditions when the gas requirements (high workloads) placed on the subsystem are high, resulting in decreased 02 concentration and a concomitant increase in nitrogen concentration along with a 5-10 percent argon concentration. The resulting data will be used to define the boundaries of the molecular-sieve subsystem where decompression will not be hazardous to crew members.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0031, GUIDANCE ON THERMAL STRESS IN AF OPERATIONS

S.A. NUNNELEY, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322590)

The goal of this effort is to set criteria for acceptable thermal stress in Air Force operations. Improved understanding of the mechanisms involved will allow development of useful predictive models as well as leading to new concepts for protective measures where stresses exceed permissible levels. Information derived will be used to provide guidance for USAF engineering groups and operational commands concerning design and use of environmental control systems and protective equipment.

Selected thermal conditions will be simulated in the laboratory where volunteer subjects can be intensively studied. The environments used will be based in part on field measurements obtained under other work units. Because physiological heat strain is a complex product of multiple factors, studies will include the effects of clothing work rate and duration of exposure. The impact of vapor barrier clothing on heat tolerance will be tested for application to current maintenance practices as well as potential chemical defense requirements. The possible protective effects of acclimatization, physical fitness, and fluid replacement will be studied. Measurements will include core and skin temperatures, evaporative loss, heart rate, metabolic rate, body fluid composition, and performance. This effort supports the ASD development of aircrew equipment and the AFFDL development of advanced environmental control systems. Coordination is being accomplished with the US Army (ARIEM), USN, NASA, AFOSR, and civilian agencies. This work was formerly done under work unit 7164-17-24.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0032, THERMAL STRESS INSTRUMENTATION

R.F. STRIBLEY, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF320100)

The purpose of this project is to design and construct a modified miniature environmental monitor (MEM) for use by the USAFEHL in conducting field thermal stress studies. Instrumentation presently available for thermal stress surveys are behind current technology, require frequent calibration, are of questionable precision, and do not measure all of the variables affecting the heat transfer of bodies within an environment. This joint effort will augment existing USAFSAM capabilities of field data collection and provide additional input, as a data base, to the thermal stress program.

In order to meet the environmental health laboratory's needs, USAFSAM/VNT plans to modify the design of the existing MEM to include multiple black globes and temperature sensors. Also, a digital recording system will be utilized to increase total system accuracy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0033, BIOENVIRONMENTAL ASSESSMENT OF HYDROGEN CHLORIDE IN SOLID ROCKET MOTOR

S.M. THOMAS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF320840)

Large solid propellant rocket motors release quantities of hydrogen chloride (HCl) as a product of combustion. Since HCl is a potential environmental hazard, measurement of its concentration in the established ground cloud becomes important to validate diffusion estimates governing launch constraints, as well as to assess the biological impact of chemical reactions which may occur between gas, aerosol and solid in the exhaust plume. The objective of this effort is to develop criteria and analytical techniques for monitoring of exhaust HCl as gas, aerosol and total chloride. The work supports operational requirements from SAMSO and SAMTEC as well as NASA and AFRPL. This effort is a continuation of JON 71641606 and will implement the new technical planning objective directed by HQ Aerospace Medical Division.

A threefold analytical approach has been implemented to provide detection methodology for the various forms of HCl, infrared correlation spectrophotometry for gaseous HCl, chemiluminescence analysis for HCl in gaseous and aerosol forms, and microcoulometry for total chloride. Following laboratory and field testing of chemiluminescence analysis and microcoulometry, recommendations were made to SAMTEC on their applicability for both ground and airborne monitoring instrumentation. A second approach to determining HCl behavior within the exhaust cloud has been initiated. Laser Raman spectroscopy will provide a better description of the cloud's environment, such as the partitioning of the various forms of HCl.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0034, USAF CENTRALIZED WAIVER REPOSITORY (WAVR FILE)

G.O. TOLAN, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322050)

To tabulate in a readily available computerized form the essential medical data on rated personnel who receive waivers for medical defects in order to continue flying duties. To provide to the Surgeon General, USAF, and to the surgeons of the major air commands, on a periodic basis, the information required to assure timely administrative review of waivers and appropriate evaluation or reevaluation of significant medical problems in flying personnel.

AFM 160-1, paragraph 3-6D(6), requires submission of identification and medical data to USAFSAM by waiver authorities every three months. Information from the USAF military personnel center regarding changes in base and command of assignment is also entered. Publication of the file is also accomplished on a quarterly basis. In addition to a master file, or complete list, sent to the Surgeon General's office, each major air command surgeon's office is furnished with a list of individuals within that command and a suspense list (by waiver expiration date) for the following three months. Capability will be maintained for searching the file for any diagnostic or other medical terms and will be responsive to requests from the major air command or surgeon general's office to provide information as required. Work was formerly documented under work unit 7755-14-02.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0035, OPTIMAL SINGLE LEAD EXERCISE ELECTROCARDIOGRAPHIC LEAD SYSTEM FOR IMMEDIATE RISK FUNCTION EVALUATION IN THE FIELD
R. WOLTHUIS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321630)

At the present time exercise stress testing is conducted in a non-standardized fashion throughout the Air Force and, as a result, many of the stress tests are uninterpretable. This effort will define an optimal single lead electrocardiographic lead system which has a high degree of sensitivity and specificity for detecting coronary disease in the aircrewmember for use during dynamic stress testing and at the same time can be used Air Force wide with little expenditure of resources or skill.

Multiple leads will be recorded during exercise stress testing of aircrewmembers for measurements utilizing automated ECG analyses. These measurements will be compared to the results of the clinical evaluations including coronary arteriography and the cardiopulmonary responses to stress testing. Various dynamic stress tests will be utilized to establish a single lead system that has applicability to the various forms of stress testing available throughout the AF. This work was formerly documented under 7755-01-05.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0036, CRITERIA FOR ABNORMAL ECG RESPONSE TO EXERCISE STRESS TESTING USING 3-DIMENSIONAL ANALYSIS OF ORTHOGONAL LEAD SYSTEMS
R. WOLTHUIS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321830)

Less than 50 percent of aircrewmembers subjected to coronary arteriography because of an abnormal electrocardiographic response to exercise stress testing have obstructive coronary artery disease. This effort will better define normal versus abnormal criteria of interpreting electrocardiographic responses to exercise stress testing using widely accepted orthogonal lead systems to establish a more reliable immediate risk identification of aircrewmembers with potential coronary artery disease.

Orthogonal electrocardiograms will be recorded during exercise stress testing and subjected to automated three-dimensional analyses. Results will be correlated with clinical evaluations including coronary arteriography and the cardiopulmonary responses to exercise stress testing. Noninvasive methods for evaluating the circulatory responses (e.g., echocardiography) and the effect of drugs (e.g., propanalol) on the repolarization response to exercise will be utilized and correlated with the results of left ventricular angiography and coronary arteriography. This work was formerly documented under 7755-01-05.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0037, CARDIOVASCULAR ADAPTATION TO STRESS
V.S. BISHOP, Univ. of Texas, School of Medicine, *San Antonio, Texas* 78284 (DF036860; AF-AFOSR-2525-73)

AF function - the Air Force must perform its mission under conditions which expose personnel to a number of environmental and psychological stresses including temperature extremes, varying oxygen tensions, maneuvering forces, fatigue and prolonged flights across several time zones. The circulatory system is one of the physiological systems which early shows operator malfunction due to such stress. An indicator for predicting performance reliability of the individual under stress has long been sought. Deficiency - little is known about the role of the cardiopulmonary receptors in the regulation of heart rate and peripheral vascular resistance. Objective - this study will examine the effects of stress on the cardiovascular system. How work contributes -these data should assist in developing an understanding of the basic mechanisms of adaptation and contribute to needed technology. This research supports RO 1.7, 'aerospace medicine' and RO 1.6, 'aircrew safety and effectiveness in mechanical force environments'.

It is proposed to thoroughly investigate compensation provided by neural reflexes during stress using chronically instrumented animal subjects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, CONTROL AND COMMUNICATION SYSTEMS APPLICABLE TO THE DESIGN OF AEROSPACE SYSTEMS
A.V. BALAKRISHNAN, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (DF036100; AF-AFOSR-2492-73)

AF function - design of advanced aircraft and jet engine control systems. Deficiency - nonlinear system models need to be identified to establish criteria upon which the controller of that system is designed. Objective - the objectives of this research are the development of efficient computing algorithms for optimal trajectories based on the epsilon techniques, the development of theory and techniques for determining stability derivatives of aircraft based on measurements in flight which include wind-gust effects and design of a stability augmentation system thereof - and the development of a theory of model control for flexible aircraft on a realistic distributed parameter model. How work contributes - success in these objectives would contribute to the performance of aircraft and jet engine control systems.

The feasibility of the epsilon technique will continue to be investigated for the efficient generation of time-optimal trajectories for the full nonlinear jet engine model with realistic control and state constraints. Besides the development of a user software package to handle aircraft parameter identification problems from flight data in the presence of turbulence, an attempt will be made to use the techniques to engine data. The application of linear quadratic regulator theory will be applied to the mode control of systems, typically described by distributed parameter models. In addition control algorithms will be investigated which will automatically adapt to changes in system parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0002, MATHEMATICAL THEORY OF NONLINEAR WAVE PROPAGATION
G.B. WHITHAM, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (DN525213; N00014-75-C-0702)

The mathematical research being done under this task responds to naval requirements for prediction and control of physical phenomena in the fields of oceanography, meteorology, gas dynamics and plasma physics. The mathematical theory of nonlinear wave propagation is particularly relevant to naval

research in oceanography. This work provides fundamental insight into the propagation of both internal and surface waves and water waves on a beach.

Research is being done in the mathematical theory of nonlinear wave propagation and related problems in the general theory of partial differential equations. This work includes the investigation of variational principles for nonlinear wave problems and the study of the general mathematical structure of partial differential equations derivable from variational principles.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0003, ALGEBRAIC FOUNDATIONS OF STABILITY THEORY
M. MARCUS, Univ. of California, School of Letters & Science, *Santa Barbara, California* 93106 (DF046720; AF-AFOSR-3166-77)

AF function - the design of stable control systems is essential in the development of effective aerospace vehicles. Deficiency - the stability of nonlinear control systems cannot be analyzed by standard techniques. No effective techniques are useful in the study of control systems of interest to the Air Force. Objective - this research intends to study the stability theory for systems of ordinary differential equations that describe any dynamical system. It will be concerned with eigenvalue localization theorems for finite matrices. How work contributes - schemes for determining the stability properties of control systems will be developed.

This research will cover these specific topics: (1) an investigation of the geometric structure of the numerical range of a transformation, this set is always an inclusion region for the eigenvalues, (2) the construction of easily computable estimates for the eigenvalues of sums and product of finite matrices in terms of the eigenvalues and entries of the summands or factors, (3) localization of eigenvalues under conditions of special constraints on the matrices or their spectra, (4) bounds for computable matrix functions in terms of eigenvalues and other invariants, (5) investigation of unresolved questions in linear algebra involving matrix eigenvalues and diagonal elements, and eigenvalues of matrix sums, (6) localization of eigenvalues of matrices of special type, (7) computational techniques for the permanents of m x n matrices, and (8) to develop a computerized retrieval system for research publications in linear algebra.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0004, A PRELIMINARY INVESTIGATION OF THE TRANSPORTABILITY OF IMAGE PROCESSING SOFTWARE AMONG SEVERAL COMPUTER SYSTEMS
R.L. DANIELSON, Univ. of Santa Clara, School of Engineering, *Santa Clara, California* 95053 (NCA 2-685804)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0005, NUMERICAL SIMULATION OF SPACECRAFT CHARGING PHENOMENA
J.G. LAFRAMBOISE, York University, *Toronto, Ontario, Canada* (DF043460; AF-AFOSR-2962-76)

AF function - electrical and surveillance systems on Air Force satellites have been disrupted by transient signals associated with differential charging of the spacecraft. Deficiency - theoretical studies of spacecraft charging are needed to aid in the design of experiments and the interpretation of the data. Objective - a numerical model is to be developed to simulate the plasma sheath surrounding a spacecraft. Contribution - this study will provide a theoretical model to understand the data obtained from the SCATHA (spacecraft charging at high altitude) satellite and other spacecraft charging phenomena.

A two-dimensional cylindrical model will be developed using realistic data on incident particle energy spectra, secondary electron emission spectra, internal conducting pathways within the spacecraft and emission from electron of ion guns. The model will simulate both steady-state conditions and transient phenomena.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0006, DIRECT AND INVERSE PROBLEMS IN OBSTACLE SCATTERING FOR APPLICATION IN DETECTION, IDENTIFICATION AND COMMUNICATION
R.E. KLEINMAN, Univ. of Delaware, School of Arts & Sciences, *Newark, Delaware* 19711 (DF038150; AF-AFOSR-2634-74)

AF function - radar target recognition. Opportunity - target vibration affects radar return. Objective - analytical relations between target eigenmodes and the radar return. How work contributes - engine vibration aerodynamic flutter, etc., characteristics, if determinable from the radar return, would improve target recognition capabilities.

A simplified model for scattering from vibrating bodies will be derived mathematically using asymptotic techniques and tested against experimental data. Other research areas being continued include application of optimal control methods to impedance loading problems in order to find that loading or induced current distribution on a surface which optimizes a desired scattering or radiation characteristic, and extension of integral equation scattering techniques to higher frequencies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0007, MATRIX METHODS FOR SPECIAL FUNCTIONS ARISING IN APPLICATIONS
Y. IKEBE, Northwestern University, Graduate School, *Evanston, Illinois* 60201 (DF046590; AF-AFOSR-3183-77)

AF function - design of structures for aerospace vehicles. Opportunity - the use of matrix-theoretic techniques for the numerical computation of certain quantities associated with vibration and stability problems has not been exploited. Objective - this research intends to convert problems of computation of zeros of functions and eigenvalues of equations into problems in matrix theory which are solvable using readily available computer subroutines. How work contributes - the computation of zeros of functions will become more efficient and reliable.

Algorithms for computing the characteristic values of Mathieu's equation, the zeros of the regular Coulomb wave function and their derivatives will be constructed. A detailed investigation of the nature of the complex zeros of the Bessel functions will be made. An investigation of computational methods for the eigenvalue problems associated with the spheroidal wave equation and lame equation will be pursued. Emphasis will be placed on the computational aspects of this analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0008, TECHNICAL END ITEM SUPPORT FOR THE STATISTICAL ANALYSIS AND MODELING OF AIR TRAFFIC CONTROL SYSTEM PERFORMANCE
UNKNOWN, Princeton University, Graduate School, *Princeton, New Jersey* 08540 (FA77NA-4047; FA160450 (TRAIS NO.))

The results of this study will provide the FAA with effective technique of incorporating empirically derived measures into operational system analysis. Furthermore, this effort will be a determinant in demonstrating the feasibility of using fast-time simulation modeling in forecasting and prediction work and in being able to relate simulation output with analytical solutions.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

7.0009, INFERENCE UNDER ORDER AND SMOOTHNESS RESTRICTIONS WITH APPLICATIONS IN TIME SERIES ANALYSIS
E.J. WEGMAN, Univ. of North Carolina, School of Arts & Sciences, *Chapel Hill, North Carolina* 27514 (DF041150; AF-AFOSR-2840-75)

Air Force function - vibration control, sonic fatigue, signature control/masking, forecasting ionospheric outages, study of amplitude and phase fluctuations for signals from vhf to l band, identification of plume signature, effect of nuclear detonation on

radar and optical systems, guidance errors as a function of motion field, atmospheric optics. Deficiency - a weakness of isotonic estimation procedures has always been that they are step functions, hence not continuous. Often it is known that the function to be estimated is continuous as well as isotonic and, hence, the usual isotonic estimator is unsatisfactory. Objective - it is proposed to develop a theory of isotonic splines, which would incorporate both the smoothness and the order-preserving properties. This would include development of computational algorithms and presumably some results to show that the isotonic splines were norm-reducing and that they preserved optimality properties such as maximum likelihood. How work contributes - find optimal methods for estimating smooth functions under some order restrictions.

The trend in a time series often shows a monotone or oscillating character. The estimation and removal of such trend would be a clear and useful application of the theory of isotonic splines and isotonic regression. In response problems it is of practical importance to estimate either the impulse response function or the filter weights under the assumption of isotonicity and, where appropriate, smoothness. The gain and phase shift are often used to investigate the action of filters. In particular the gain is frequently known to be smooth and satisfy some order relationship. Hence estimation of gain and phase under order and smoothness restrictions would be of particular importance. A related aspect is to develop methods to test the hypothesis that a filter had a prespecified gain or phase shift function.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0010, NASTRAN COMPUTER PROGRAM
J.R. JOHNSON, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF132120)

Structural strength, integrity, service life and minimum weight are vital concerns in the design and analysis of aerospace vehicles to insure that they perform the intended mission. The objective of this effort is to develop efficient general-purpose finite-element structural analytical methods that will directly support the design and analysis of structures for strategic, tactical, training and logistic aerospace vehicles. The successful accomplishment of this objective will insure the ready capability to provide the analysis support for aerospace systems, such as the B-1, CCV and RPV, with a minimum of elapsed time, and, to provide a NASTRAN focal point for the WPAFB NASTRAN users group.

Coordinate the efforts of the users group. Provide consultation and direction as required to use, maintain and modify the computer program. Serve on the HQ NASA NASTRAN Advisory Group (NAG).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

7.0011, APPLIED ANALYSIS
M.G. CRANDALL, Univ. of Wisconsin, Mathematics Research Center, *Madison, Wisconsin* 53706 (DA0M9690; DAAG29 75 C 0024)

Continue and extend studies of differential equations in order to provide a better foundation for the design of Army weapons, vehicles, aircraft, communications and supply systems, and protective equipment. There will be special attention to the influence of boundary conditions on the character of the solutions, special study of the asymptotic behavior of the solutions near singular points, and special attention to other topics from time to time.

A staff of mathematicians who are proficient in this area is regularly employed. A weekly seminar in which problems are discussed and new results are presented stimulates interaction of the members of this group with each other and with interested colleagues from other groups within the center and with members of other departments. Access to an electronic computer, with programming support, is provided to aid in numerical experimentation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, THEORETICAL STUDY OF EQUATORIAL F REGION IRREGULARITIES
F.S. MOZER, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (NSG 7401)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0002, LIGHT SCATTERING STUDIES OF THE FAR INFRARED DIELECTRIC PROPERTIES OF SEMICONDUCTORS
S. USHIODA, Univ. of California, School of Physical Sciences, *Irvine, California* 92664 (DF047080; AF-AFOSR-3222-77)

AF function - aerospace communications surveillance and detection systems require electrooptical devices which exploit the special properties and interactions of infrared radiation with solid-state materials. Opportunity - the far infrared region of the electromagnetic spectrum has been virtually unexplored for airborne and satellite applications. Sophisticated electrooptical techniques and characteristics of narrow band-gap compound semiconductors offer promise for electrooptical microcircuitry in the spectral range 10 to 100 micrometers. Objective - the main purpose of this research is to explore the far infrared dielectric properties of several semiconductors, in the bulk and near the surface, by means of inelastic laser light-scattering spectroscopy, and to study elementary excitations that contribute to the dielectric properties such as phonons, bulk and surface polaritons, plasmons, and low-lying single-particle electronic excitations. How work contributes - the far infrared dielectric (optical) properties of these semiconductors are important to the development of infrared detectors, solid-state lasers, integrated optics and electrooptical techniques and devices concepts.

Laser Raman scattering spectroscopy utilizing tunable dye lasers is being used to probe the far infrared properties of semiconductors. For the study of the surface layers of III-V and II-VI compound semiconductors, back-scattering Raman spectroscopy will be used. For the study of surface polaritons, thin-film layered structures are being synthesized by vapor deposition techniques to clarify the mechanisms for electron-phonon interactions and for generating surface waves in these materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0003, SURVEILLANCE - PROPERTIES OF NONEQUILIBRIUM SUPERCONDUCTORS
D. ROGOVIN, Science Applications Inc., *La Jolla, California* 92037 (DN675285; N00014-76-C-0640)

The objective is to theoretically study cooperative effects in superconducting Josephson junction systems which can be used in surveillance and communication systems of naval interest. A conference on transient effects in Josephson devices will be organized.

The dynamic processes by which the phases of the wave functions describing individual electron pairs are locked to form a single-phase for bulk superconductors and Josephson junctions will be examined in detail. Superconducting arrays systems will theoretically be studied with the intent of determining the conditions necessary for mode locking, the structure of the self-generated radiation field and the noise characteristics of the system.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0004, SURVEILLANCE - MULTIPHOTON PHOTOIONIZATION SPECTROSCOPY
M.D. LEVENSON, Univ. of Southern California, School of Letters Arts & Sci., *Los Angeles, California* 90007 (DN575360; N00014-75-C-0950)

The technical objective is to study the interaction of atoms and molecules with moderately intense laser fields, with special emphasis on 2-photon and Raman resonances and multiphoton ionization. Naval applications in surveillance, weaponry, and communications require an improved understanding of these types of atomic and molecular interactions.

The approach used will be to study multiphoton photionization processes. The experimental approach that will be used represents a compromise. Rather than measuring the angular distribution of the emitted electrons, the ratio of the total emission in various polarization conditions will be measured. Relative cross sections will be measured rather than absolute cross sections, abd instead of working far from intermediate states, these studies will emphasize the effects of these resonances. In this way, many experimental and calculational difficulties can be avoided, with the result that any deviation of the experiment from the theoretical predictions will be real rather than experimental artifacts. The advantage of this technique is that the measurement of the polarization ratios as a function of frequency provides very nearly as much informatin as the much more difficult measurement of the angular distribution of the emitted electrons.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0005, WAVE PARTICLE INTERACTIONS IN THE MAGNETOSPHERE
UNKNOWN, Stanford University, Graduate School, *Palo Alto, California* 94305 (NAS 5-24409)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0006, III-V COMPOUND SEMICONDUCTOR MIS DEVICE TECHNOLOGY
D.L. LILE, U.S. Navy, Electronic Engin. & Sci. Dept., *San Diego, California* 92152 (DN587501)

To develop the technology base for semiconducting III-V compound metal insulator-semiconductor (MIS) devices and circuits. To apply crystal growth procedures and compatible dielectric deposition techniques to the fabrication of III-V compound MIS field effect transistors (FETs) both as single devices and as elements of multi-element arrays and circuits and to evaluate the materials, the devices and their characteristics with regard to their potential applications as microwave and mm wave components. Such devices and technology are expected to have important applications in microwave logic and communications systems.

The materials technology for gallium arsenide is available as a result of the FY 76 and 77 project Z102. This technology is being applied to the development of refined device and circuit structures on gallium arsenide and is being extended to encompass the more attractive gallium indium arsenide phosphide system. Such work will require the control of epitaxial semiconductor growth, of dielectric and interface properties and of device technology.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

8.0007, OPTICAL AND MAGNETIC RESONANCE STUDIES OF ENERGY TRANSFER IN INORGANIC MOLECULAR SOLIDS 14771-C
E.R. BERNSTEIN, Colorado State University, School of Natural Sciences, *Fort Collins, Colorado* 80523 (DA0F8994; DAAG29 77 G0133)

To study the dynamical processes of energy transfer, radiationless deactivation, electron-phonon coupling, and multiparticle states coupled to local sites occurring in molecular inorganic crystals. Relevance -this research is responsive to the development requirements of the Army for solid-state lasers for utilization in range finders and other target designators. In addition, knowledge to be gained will also contribute to other areas of Army interest such as optical materials, phosphors, and solid-state devices.

These phenomena will be investigated with zero field paramagnetic resonance (ZFPMR), emission studies, and optically detected magnetic resonance in pure and two- and three-component single crystal systems.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0008, CHARACTERIZATION OF SEMICONDUCTING MATERIALS FOR MICROWAVE DEVICES
B.D. MCCOMBE, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN580057)

To develop and utilize suitable techniques for the characterization of the chemical, structural, surface and electrical properties of gallium arsenide and indium phosphide substrates, epitaxial layers, and test devices at each stage of fabrication. To develop a set of material specifications which are both necessary and sufficient to insure high-quality TED and FET devices.

A coordinated growth and characterization effort on both bulk substrates and epitaxial layers will be pursued. Materials and devices obtained from outside laboratories will also be studied for comparison purposes. Both routine and innovative techniques will be utilized to characterize the materials at various stages, and these parameters will be evaluated in relation to final device properties. Those parameters which are necessary and sufficient to insure good device performance will be defined and material specification prepared.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0009, TWO- AND THREE-BODY CORRELATIONS IN SIMPLE GASES
J.W. DUFTY, State University of Fla. Sys., School of Arts & Sciences, *Gainesville, Florida* 32601 (PHY76-21453 A01)

A theoretical and experimental study of static and dynamic correlations (two- and three-body) in simple fluids will be continued. The approach is based largely on information contained in the pressure dependence of the pair correlations, and is stimulated in part by the recently acquired ability to perform accurate neutron diffraction and scattering experiments on gases at low to moderate density. The pressure (or density) dependence of the pair correlation functions measured in this way provides a new probe of the form and importance of (1) three-body forces in atomic fluids, (2) three-point time correlation functions, and (3) pair correlations (e.g., atom-atom) in simple molecular fluids. These complementary aspects of the structure of fluids will be studied simultaneously. Neutron scattering studies on xenon are in progress and will be continued. As an extension of this program, we plan to carry out a neutron diffraction experiment on gaseous DCl, using isotopic substitution (DCl 35 and DCl 37) to obtain the partial structure factors and the internuclear distribution functions.

This work represents a continuation of that currently supported by Foundation grant PHY73-04818A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0010, COMMUNICATIONS - ELECTRICAL AND MAGNETIC PROPERTIES OF SEMICONDUCTORS
F.A. BENEDETTO, Loyola Univ., School of Arts & Sciences, *New Orleans, Louisiana* 70118 (DN524376; N00014-75-C-1099)

The Navy has need for increased performance of solid-state devices in electronic systems. Experience gained from this work unit will lead to increased efficiency in the production of solid-state components.

Government-owned equipment will be used to study electrical and magnetic properties of selected semiconductors, grow and prepare semiconductor crystals, perform thin film evaporations and do related experiments at low temperatures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0011, SURFACE SPECTROSCOPY
R.L. PARK, Univ. of Maryland, School of Engineering, *College Park, Maryland* 20740 (DN575148; N00014-75-C-0292)

The solution of Navy problems involving corrosion, catalysis, electrode reactions, electron emission, and environmentally sensitive mechanical behavior would be enhanced by the development under this contract of better ways to measure surface composition and electronic structure.

X-ray or electron excitation or Auger electrons will be examined with appearance potential spectrometers to give fine structure information on the density of final electron states. Background effects will also be studied to eliminate these sources of error.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0012, RESONANCE AND RADIATION PHYSICS
R.V. POUND, Harvard University, School of Engineering, *Cambridge, Massachusetts* 02138 (DMR76-84497 A01)

Research will be carried out on resonance phenomena such as Mossbauer effect and NMR applied to particular examples. The two Mossbauer resonance examples, 67Zn and 181Ta, are chosen as the most promising for improving available resolution of small energy shifts. Exploration of line width, depth and isomer shifts of 67Zn in metals and semiconductors is planned as a supplement to past success with zinc chalcogenides. Efforts to improve the resolution available from 181Ta are planned.

Another project is the further development of X-ray light pipes. Use of synchrotron radiation of SSRP as a medium to explore nuclear resonance fluorescence, particularly if 181Ta depends upon the development of a detector with rapid recovery from overload. Finally, continued studies of NMR at low temperature of (approximately 0.05 degrees K) and high fields particularly, will be carried out with further work on the ortho-para conversion in H2 and on the NMR of H2 and D2 at lower frequencies.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0013, INFRARED NONLINEAR OPTICS IN SEMICONDUCTORS
P.A. WOLFF, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (DF041830; AF-AFOSR-2894-76)

AF function - secure space communications and covert optical electronics require devices which exploit special properties and interactions of materials with far infrared radiation. Opportunity -infrared materials research has a high potential impact on novel detectors, sources and communications for airborne and spaceborne applications. Objective - this effort combines theory and experiment to investigate a variety of infrared nonlinear optical energy transfer processes in narrow band-gap semiconductors for generating coherent far infrared tunable sources of radiation. How work contributes - these interactions and unique phenomena should provide a basis for developing useful tunable, infrared sources for communications and radars and diagnostics of rocket plumes and exhaust.

The following nonlinear processes involving mobile and weakly bound electrons in semiconductors are being studied - stimulated impurity Raman scattering in N-Ge and N-Si, resonant, field-induced nonlinearities due to impurities, radiation from parametrically excited plasma waves, resonant, spin-flip scattering in InSb and (Cd,Hg)Te, stimulated, far-infrared spin flip scattering, resonant, spin-induced difference frequency generation, stimulated, bulk plasma-wave scattering, and sideband generation via spin precision.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0014, POSITRONIUM EXPERIMENTS
S. BERKO, Brandeis University, School of Arts & Sciences, *Waltham, Massachusetts* 02154 (PHY76-23883 A01)

Positronium (Ps), the electron-positron bound state, has long been recognized as the ideal 'atom' to be investigated as a test of the quantum electron-dynamical theory of atomic systems. Over the past 25 years this promise has been in the process of being realized through ever-increasing precision investigations of the ground state (n equals 1) of Ps. However, it has been only until very recently that the elusive first excited state (n equals 2) could be produced and a preliminary investigation of its fine structure carried out, thus laying the groundwork for precise testing of the 'Lamb shift' self-energy effects normally not accessible in the n equals 1 experiments. This recent discovery is based on n equals 1 and n equals 2 Ps emission from solid surfaces that are bombarded with a beam of low-energy positrons. Research will continue to improve on the preliminary n equals 2 measurements through improved microwave techniques and an investigation of the Ps emission. In addition to improving the direct emission of n equals 2 Ps, the investigations will also be aimed at using the extremely efficient n equals 1 Ps emission phenomenon for valuable information relevant to the n equals 2 work as well as other important areas of Ps research such as n-1 Ps-atom collisions, Ps interactions with external electromagnetic fields, and n equals 1 Ps lifetime measurements.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0015, LASER INTERACTION AND X-RAY EMISSION FROM METALLIC PLASMAS
R.S. ONG, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (DF041670; AF-AFOSR-2904-76)

AF function - operation of high-altitude vehicles in a post-nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand advanced equipment unavailable to date. Deficiency - present-day information is inadequate to design the aforementioned equipment. Such information may be obtained from experimental and theoretical work in metallic (collisional) plasmas. Objective - this project will investigate theoretically the behavior of high-density, high-z and moderately high-temperature plasmas which are strongly dominated by collisional and partial ionization phenomena. Such plasmas are metallic plasmas produced by exploding wires. This theoretical work will be coordinated with the experimental work on exploding wires performed by Prof. Bach. Contribution - this work is a part of a comprehensive program on plasma research for the development of an X-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and ion beam), the development of space and ionospheric communications and the development of countermeasures.

This project will investigate the following four areas - (a) MHD plasma simulation incorporating a satisfactory radiation transport description. This radiation transport and reabsorption is very important in the study of X-ray emission of optically thick metallic plasmas. The aforementioned description will be based upon collision probability methods, (b) collision and transport phenomena in ultra-high density plasmas will be investigated. They will use the kinetic equation they developed which characterizes fluctuations in high-density plasmas to determine transport coefficients and compare these with the Spitzer values, (c) self-focusing and filamentation instability in the z-pinch and exploded wire plasma will be continued with special attention to their geometry and parameters. A cylindrical symmetric beam is assumed with a Gaussian distribution along the radius, (d) soliton-like structures in plasmas violently disturbed by an intense laser beam will be investigated. These may be generated by a self-focusing process, parametric excitation and others. The effect of the exponential nonlinearity in the Schroedinger equation regarding the collapse of Langmuir sound modes appearing in a turbulent plasma.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0016, NONLINEAR OPTICAL PHENOMENA IN SOLIDS
P. KRUSE, Honeywell Incorporated, *Minneapolis, Minnesota* 55413 (DF046920; F49620-77-C-0028)

AF function - aerospace communications surveillance and detection systems require devices which exploit special properties and interactions of infrared radiation with solid-state materials.

Opportunity - the far-infrared region of the electromagnetic spectrum has been virtually unexplored for military applications. Narrow bandgap semiconductors offer technological promise for spin-flip Raman laser sources and as infrared detectors of objects against a cold space background in the spectral range 15 to 30 micrometers. Objective - this research investigates (Hg, Cd)Te single crystals as a useful material for generating nonlinear coherent far-infrared sources and detectors. Also, it seeks an understanding of the properties of narrow bandgap semiconductors which make them resistant to laser damage. How work contributes - the interaction effects and unique properties of (Hg, Cd)Te should provide a basis for developing useful tunable, far-infrared sources and detection for adverse weather communications and radars, astronomy, spectroscopy and plasma diagnostics needed for aerospace electrooptical and electromagnetic devices.

Crystal growth and characterization studies are being undertaken. (Hg, Cd)Te crystals are grown by the modified Bridgman (quench/anneal) technique. Spatial profiles of the single crystals are determined by measuring their composition and purity, density, Hall coefficient resistivity and optical absorption. Spin-flip Raman laser studies are conducted on a sample prepared for laser cavities. Evaluation includes spatial uniformity of the Raman signals and optimum electron concentration for aerospace applications requiring far-infrared tunable lasers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0017, A STUDY OF SOUND PROPAGATION IN THE ATMOSPHERE 14002-EX

H.E. BASS, Univ. of Mississippi, School of Liberal Arts, *University, Mississippi* 38677 (DA0E9133; DAAG29 76 G0258)

To evaluate the influence of the absorption of sound due to the ground and ground cover on prediction models for received noise levels at a point near the ground due to a low-flying helicopter. Relevance -the proposed research is strongly relevant to the requirement for undetectable nap-of-the-earth helicopter operations, to artillery sound ranging and, to a lesser degree, to the operation of remotely monitored battlefield sensors.

Small-scale experiments will be performed to measure the acoustic properties of snad and grass of various heights in situ. Experimental and theoretical results will be compared for sound propagating over this same ground and ground cover at near-grazing incidence.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0018, KINETIC REACTION COEFFICIENTS IN ROCKET EXHAUST PLUMES

W.R. SNOW, Univ. of Missouri, School of Arts & Sciences, *Rolla, Missouri* 65401 (DF038680; AF-AFOSR-2672-74)

AF function - weapons delivery, defense. Deficiency - advancement of predictive, detection, preventive and other techniques in rocket plume technology has been hampered by lack of fundamental reactive and radiative data. Specifically, determination of plume radar cross sections requires input data on charged particle reactions. Objective -this four-year program is to provide measured data on ionization, recombination, attachment and detachment processes that occur with HCl and KCl and their elements. How work contributes - this work will provide data called for in research objective 5.1.2, and placed in the highest priority category by AFRPL.

Drift tube, flowing afterglow, modulated crossed beams and laser excitation techniques will be used for the various reactions to be studied. Quantitative effects of various collision partness and third bodies will be emphasized. Temperatures ranging from 300-10,000K and pressures from 0.1 to 10 sub 5 pa will be covered. Some of the important reactions being studied are ion-pair production from potassium and chlorine atoms, recombination of potassium ions as affected by third bodies, and the effect of clustering on the associative detachment of chloride ions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0019, THE ANATOMY OF THE X-RAY AND NEUTRON PRODUCTION SCALING LAWS IN THE PLASMA FOCUS

W.H. BOSTICK, Stevens Institute of Technol., School of Engineering, *Hoboken, New Jersey* 07030 (DF028840; AF-AFOSR-2754-75)

AF function - operation of high-altitude vehicles in a post-nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures, demand the fundamental understanding of energy transformation processes occurring in plasmas such as magnetic vortex annihilation and emission of photons and particles. Deficiency - the aforementioned information required to design advanced equipment is not available today. Its acquisition may be realized by a well-planned theoretical and experimental research. Objective - this project will investigate both theoretically and experimentally the fundamental characteristics of energy transformation processes. It will specifically study the anatomy of the X-ray and neutron production similarity and scaling laws in the dense plasma focus. Contribution - this work is a part of a comprehensive program of plasma research for the development of an X-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications, and the development of countermeasures.

This project will perform theoretical and experimental work to understand the energy transformation processes occurring in a dense plasma focus. They will perform the following measurements - (a) X-ray pinhole imaging of the nodules and larger background areas with various Be-filters to measure the absolute X-ray spectrum coming directly from the plasma, (b) measurement with Ross-filters and scintillators and X-ray collimators of the location and spectrum of the x-ray sources at the anode surface in the 20 kEV to 1 mEV range, on an absolute basis, and the number of X-ray pulses, (c) measurement of total neutron yield with silver activation counters and also with scintillators and collimators of the number of neutron pulses in the two areas a and b. The measurement of the shape of the neutron pulses can be turned into the spectrum of the deuteron beam which flows first through the nodule and then through the background gas. They will design and build a new DPF to perform the same measurements as before. In addition to the foregoing, they will measure the effect of laser irradiation on the neutron production as well as the X-ray yields.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0020, MATERIAL SUPPORT TECHNOLOGY - DEFECTS IN SEMICONDUCTORS

J.W. CORBETT, State University of New York, School of Arts & Sciences, *Albany, New York* 12222 (DN123026; N00014-75-C-0915)

Studies of defects in semiconductors, defects produced by radiation or by ion implantation of foreign species are of great importance to a broad spectrum of Navy electronics systems. Radiation effects studies support nuclear radiation vulnerability programs and ion implantation studies support new material and electron device technology.

There are three correlated aspects to this task: (1) EPR measurements on silicon and diamond which have been irradiated by electrons or neutrons or have been implanted with a variety of impurity ions; (2) correlated EPR-photoresponse and EPR-transient capacitance techniques are used to identify defects and determine energy levels and carrier capture cross sections; (3) use of radioactive tracer techniques to survey a variety of impurities (including gold and zinc) to test predictions for ionization-enhanced diffusion mechanisms in silicon, germanium, and gallium arsenide. This program will identify the radiation and impurity induced defects in semiconductors which are identified by EPR, optical and electrical measurements in silicon, diamond, and gallium arsenide.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0021, PROGRAM OF RESEARCH IN THE STUDY OF QUANTUM FLUIDS
J.D. REPPY, Cornell University, School of Arts & Sciences, *Ithaca, New York* 14853 (DMR77-24221)

Experimental studies of superfluidity in helium-three and helium-four previously supported by DMR75-08624 will be continued. The emphasis will be on the development of methods for the measurement of properties common to superfluid helium-three and helium-four. As an example, a high-precision oscillator technique has been developed and applied to the measurement of the viscosity and superfluid density in liquid helium-three. It is now proving possible to use this same method for the measurement of the superfluid density of thin films of adsorbed helium-four atoms where the density of a superfluid surface gas is less than 0.1 monolayers. An important area is the study of the existence and stability of persistent current states in superfluid helium. This problem has been investigated extensively with helium-four where a great deal is now known about the stability of persistent current states. A major part of the research effort proposed will be directed toward a similar examination of the flow properties of the helium-three superfluid state.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0022, DRIVEN AND SPONTANEOUS DISSOCIATION OF MOLECULES 14473-P
E. MONTROLL, Univ. of Rochester, School of Arts & Sciences, *Rochester, New York* 14627 (DA0F8902; DAAG29 77 G0060)

To investigate theoretically the nonlinear dynamics of the dissociation of medium-sized molecules as well as the nonlinear dynamics of the generation of shock waves in crystalline solids. Relevance - the proposed work is directly relevant to ongoing work on energetic processes in metastable materials at Picatinny Arsenal, to shock wave propagation studies at BRL, and to molecular dynamics calculations on metals at AMMRC. It also has broader potential relevance to areas involving chemical reactions, phase transitions, propagation of heat through solids, etc.

Both classical and quantum mechanical analytical (rather than numerical) approaches developed by the P.I.'s will be used--specifically, series expansions will be used that are so rapidly convergent that a few analytic terms will suffice. Also, exploit high-speed computers to do bookkeeping on the terms so as to go to extremely high orders and accuracy.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0023, COHERENCE THEORY WITH SPECIAL REFERENCE TO ENERGY TRANSFER BY ELECTROMAGNETIC RADIATION 14074-P
E. WOLF, Univ. of Rochester, School of Arts & Sciences, *Rochester, New York* 14627 (DA0E9255; DAAG29 77 G0006)

To develop the theory of propagation of coherent electromagnetic radiation through atmospheric media. Relevance - the proposed work is relevant to problems of discrimination in laser radar applications directly related to electronic warfare labs's optical programs and to MICOM's radar programs.

The approach will unify the theory of radiometry, the theory of heat radiation and the theory of radiative transfer at fundamental classical and quantum levels.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0024, ALUMINUM NITRIDE HEAT SINK CRYSTAL GROWTH
G.A. SLACK, General Electric Company, *Schenectady, New York* 12305 (DF042520; F44620-76-C-0039)

AF function - microwave circuits are essential elements of Air Force reconnaissance, surveillance, communications and countermeasures systems. The development of improved solid-state microwave circuits requires devices that operate at higher power levels than presently available. Opportunity - one of the major problems in using high-power semiconductor devices is the extraction of heat generated during this operation. Heat sink substrates to which the devices are bonded should be both good electrical insulators and good thermal conductors. One possible material for such a substrate is synthetic diamond, but it is too expensive for wide use; another is beryllia, but it is toxic. Objective - the objective of this research is to grow AlN crystals of sufficient size and purity to be utilized as heat sink substrates for high-power microwave devices. How work contributes - this research could produce AlN crystals that would solve the heat sink problem.

Aln single crystals will be prepared from AlN powder by sublimation in a sealed tungsten or rhenium crucible and high-purity AlN ceramic will be made by the pellet drop technique. The physical parameters of the AlN single crystals and ceramics will be determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0025, A STUDY OF PHASE TRANSITIONS 14426-P
J.H. CRAWFORD, Univ. of North Carolina, School of Arts & Sciences, *Chapel Hill, North Carolina* 27514 (DA0E9154; DAAG29 77 G0159)

To develop a deeper understanding of the mechanism of phase transition in a wide class of inorganic solids. Relevance - a broad range of Army materials are dependent on the small energy difference between two phase states. An example of this is ferrelectrics which are widely used by the Army as piezoelectric and pyroelectric elements.

Study the temperature dependence of the electrical properties as a function of temperature and correlate the changes observed with the structural changes which are known to exist in the solids.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0026, PROPERTIES OF FLUID HELIUM NEAR CRITICAL POINT
H. MEYER, Duke University, School of Arts & Sciences, *Durham, North Carolina* 27706 (DF046080; AF-AFOSR-3119-77)

AF function - this proposed research primarily falls in the 5.3 research objectives which deal with electrical power for manned and unmanned aircraft, satellites and space stations as well as electrical power for unattended ground-based systems. Research is required in the generation of usable electric power from nonnuclear energy sources, distribution and conditioning of the power and the attendant material requirements. The development of superconductive rotating electrical power generators and pulsed superconductive energy storage systems require that these systems be kept below their normal transition temperature. Deficiency - research is needed in making more efficient heat transport helium systems. As an example of the need, over 90 percent of the system weight of a superconductive energy storage system results from the cryogenic coolant and its storage container. This causes severe weight, volume and reliability penalties in the helium refrigeration systems. It does not appear that high-temperature superconductors (Tc 25 degrees K) will be developed. Objective - the objectives are to study He3-He4 mixtures. Such studies include the determination of the concentration susceptibility in fluid He3-He4 mixtures near the lambda point and the tricritical point, measurement of the singularity of the concentration susceptibility in a fluid He3-He4 mixture near the liquid-vapor critical point, and determination of the asymptotic critical exponents in this same region. Contributions - this research is a part of a comprehensive program in superfluids and superconductors.

In all the experiments outlined in this proposal, the principle of measurement is the same. Two sets of horizontal capacitor plates, each with a capacity of the order of 5 pf, are rigidly mounted one on top of the other in a cell containing the fluid, the separation between the capacitor gaps being about 3 mm. These capacitors are connected on the opposite arms of a bridge circuit or they are measured individually against an empty capacity kept at the same temperature. In this way the differential as well as the

absolute value of the dielectric constant measured by the two capacitors can be observed. The concentration susceptibility is the differential of the molefraction of He3 by the difference in the respective chemical potentials of He3-He4. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0027, PROPERTIES OF FLUID HELIUM NEAR CRITICAL POINTS

H. MEYER, Duke University, Graduate School, *Durham, North Carolina* 27706 (DMR77-20827)

This research continues and extends a program currently supported under NSF grant DMR75-22615.

The research program comprises studies of 1) Concentration susceptibility of 3He-4He mixtures near the liquid-vapor critical point. 2) The thermal diffusivity ratio, mass diffusion and thermal diffusion in 3He-4He mixtures along the lambda line and near the tricritical point. 3) The thermal diffusivity ratio and mass diffusion in 3He-4He mixtures near the liquid-vapor critical point. 4) Thermal conductivity of 3He, 4He and 3He-4He mixtures near the liquid-vapor critical point. 5) Critical sound attenuation and dispersion of a 3He-4He mixture near the liquid-vapor critical point.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0028, PHONON LIFETIMES IN AMORPHOUS INSULATORS

H.E. JACKSON, Univ. of Cincinnati, School of Arts & Sciences, *Cincinnati, Ohio* 45221

SUPPORTED BY Research Corp.

8.0029, DIPOLAR DEFECT STRUCTURE OF LASER AND OTHER TRANSPARENT MATERIALS 13440-P

D. SCHUELE, Case Western Reserve Univ., Graduate School, *Cleveland, Ohio* 44106 (DA0E9113; DAAG29 76 G0222)

To discover and identify dipolar relaxation phenomena in alkaline earth fluorides and semiconductors and develop an understanding of the mechanisms involved. Relevance - the U. S. Army Metrology and Calibration Center is attempting to develop stable and accurate pressure transducers to replace dead weight piston gauges in Army calibration laboratories throughout the world. This research may lead to near zero temperature-coefficient materials by use of a straightforward doping technique which will advance that effort.

The dielectric constant and dissipation factor will be measured as a function of temperature, pressure, and frequency for solid dielectrics containing dipolar entities. The effect of the addition of dipoles to materials on the temperature coefficient of capacitance will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0030, ORIENTATION OF SOLUTE MOLECULES BY LIQUID CRYSTALLINE MEDIA AND THE INFLUENCE IN CHEMICAL REACTIONS

W.E. BACON, Kent State University, Liquid Crystal Institute, *Kent, Ohio* 44242 (DMR76-21339)

Anisotropic media, extending from one-dimensional planar ordered nematic, through helical ordered cholesteric through two-dimensional smectic liquid crystalline solvents, have significant effects on the stereochemistry and kinetics of chemical reactions. The present phase of this work examines the relation between structure of the reaction medium and relative reaction rates. This is a continuation of research under DMR 74-13173.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0031, MAGNETIC IMPURITIES AND RADIATION DAMAGE IN PEROVSKITE AND RUTILE STRUCTURED MATERIALS

W.A. SIBLEY, Okla. St. Univ., School of Arts & Sciences, *Stillwater, Oklahoma* 74075 (DMR77-12594)

This research was previously supported under DMR-7302349 A01. This research will involve the growth, preparation and optical characterization of previously little studied fluoride materials. In particular, studies of the optical and radiation damage of 3d and rare-earth impurities will be made in crystals such as MgF2, MnF2, RbMgF3 and RbMnF3. From past research in this program, it has been possible to assign optical transitions, both absorption and emission, to particular energy levels for transition metal ions such as Mn ions, Co ions and Ni ions, and to study the effect of radiation-induced defects on the optical properties of these impurities. This research will attempt to understand how energy transfer occurs in these materials and whether the lifetimes of the optical transitions are reduced greatly by the presence of defects. Also, it will be determined whether in RbMnF3 and MnF2 radiation damage affects the optical oscillator strength of the Mn ions. In general this research will continue the work of understanding up-conversion and energy transfer in these materials.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0032, THEORETICAL RESEARCH IN SOLID-STATE PHYSICS

J.R. SCHRIEFFER, Univ. of Pennsylvania, Graduate School, *Philadelphia, Pennsylvania* 19101 (DMR77-23420)

Theoretical research in condensed matter physics previously supported by NSF grant DMR-7681602 will be continued. The primary focus of this research will be in the area of surface physics. The emphasis, however, will be shifted from application of many-body theories to accurately handle exchange and correlation effects in the strongly inhomogenous electron systems encountered in surface physics problems. The one-electron methods will be improved, particularly in relation to interpreting experimental work with surface spectroscopics. Also, non-linear excitations in lattices and coupled electron-lattice systems will be investigated.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0033, PLASMA FORMATION PROCESSES IN A CYLINDRICAL SHELL GEOMETRY

R.D. BENGTSON, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (DF047950; AF-AFOSR-3259-77)

AF function - the AF has a requirement to harden systems to decrease the vulnerability to radiation damage from nuclear weapons detonations. To test system vulnerability, laboratory radiation generators must be built to simulate these radiation effects. Deficiency - present laboratory radiation generators cannot simulate in a realistic fashion the radiation intensity and spectrum of a nuclear weapon over a sufficiently large volume. Objective - the Air Force Weapons Laboratory has a program to investigate the feasibility of using a magnetically imploded metal foil to form a high-temperature plasma for use as a radiation source. This program is complementary to that at AFWL. Here the feasibility of replacing the metal foil with an annular gas shell is examined. The gas shell would have the advantage of allowing lower initial masses and therefore higher implosion velocities and therefore plasma temperatures and would also allow the use of a wider variety of materials than are available in solid foils. Contribution - this research will contribute to the development of plasma radiation sources for weapons effects simulation.

The initial phases of plasma formation are often crucial to the later behavior of many plasma devices, particularly when conditions of nearly full ionization are required in a particular geometry. The concept of forming a high-temperature, high-density plasma by electromagnetic implosion of a metal foil cylinder has been studied at AFWL. If the metal foil is replaced by a larger radius, lower mass cylindrical shell plasma, a higher temperature

compressed plasma can be produced with smaller stored energy. A major goal of this experiment will be to develop and characterize a plasma shell suitable for implementation in the imploding liner program at AFWL/DYS. Primary attention will be focused on producing a cold gas shell and obtaining a high degree of ionization in a time period less than 10 microseconds. The time evolution of the plasma will be studied with optical spectroscopy and laser interferometry. This data will be used as the basis for analyzing the physical-chemical reactions important to forming the initial plasma. The formation of the foil will be studied with various gases including hydrogen, helium, neon, and argon. The intended gas shell parameters are as follows - mass equals 10-3 gm, radius equals 20 cm, height equals 2 cm, background density 10-5 Torr.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0034, MATERIALS SUPPORT TECHNOLOGY - LOW-TEMPERATURE PROPERTIES OF MATERIALS FOR SOLID-STATE ELECTRONIC DEVICES

P. GIBBS, Utah Higher Education System, School of Letters & Science, *Salt Lake City, Utah* 84112 (DN223218; N00014-71-C-0413)

Low-temperature behavior of solids will be measured to provide support technology and provide information on the suitability of specific solid-state materials for new electronic devices for use in Navy communications and surveillance systems.

Conduct research on experimental low-temperature solid-state physics, radiation damage, nuclear magnetic resonance, electron spin resonance, and lasers, as well as related theoretical and interdisciplinary studies in chemical physics, computer science, and molecular biophysics.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0035, SUPERCONDUCTING SUSCEPTOMETRY SYSTEM

B.S. DEAVER, Univ. of Virginia, School of Arts & Sciences, *Charlottesville, Virginia* 22903 (DMR77-12268)

Equipment will be purchased to build a state-of-the-art superconducting susceptometer. Important characteristics of the apparatus are higher sensitivity, faster response time, and more versatility. Research to be performed with the susceptometer will involve a cooperative effort between the Department of Physics (Deaver) and the Department of Chemistry (Sinn). Typical problems are: 1) the study of the relationship between structure and magnetism in transition metal compounds, 2) the search for cooperative phenomena in polymeric complexes and conjugated organic compounds, 3) the observation of magnetic changes during chemical reactions, and 4) the study of excited states by measuring optically excited paramagnetism using a tunable laser.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0036, PROPOSED TECHNICAL PROGRAM FOR ATOMIC COLLISIONS - ION SOURCE DEVELOPMENT

L.W. ANDERSON, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (EY-76-C-02-0007, TASK B)

Experiments on atomic collisions of importance in ion source research are proposed. We plan to continue our research on the direct production of polarized H- or D-ions from a polarized atomic beam of Ho or Do atoms. We expect this research to lead in the very near future to the developmnt of an extremely intense source of polarized H- or D-ions. We plan to continue our measurements on the collisional stripping of H-or D-ions to form fast Ho or Do atoms. We propose to measure the cross sections for various charge changing collisions that are important in the production of fast negative ions or fast neutral beams. We shall study the negative ion equilibrium fraction when H positive ion or D positive ion are incident on alkali metal vapor targets.

RESULTS: We have developed a prototype polarized negative ion source using the direct conversion of polarized Ho or Do atoms into polarized H- or D-ions. This prototype source is already very intense with polarized ion currents up to 1.5 microamperes observed. We have measured the maximum neutral fraction when fast H-(or D-) ions are incident on a large variety of targets. We have measured the cross sections for various charge changing reactions important in the production of negative ions or fast neutral atoms.

Part 2 of 2.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0037, SURVEILLANCE - LOW-TEMPERATURE PROPERTIES OF ELECTRONIC MATERIALS FOR DETECTION DEVICES

N. KJOME, Univ. of Wyoming, School of Arts & Sciences, *Laramie, Wyoming* 82071 (DN123509; N00014-71-C-0388)

The work performed at low temperatures will characterize the behavior of prototype materials and assess suitability of certain physical effects which have technological importance for surveillance and communications. Effects are studied in materials finding use in infrared systems, optical systems, and electronic devices.

Gaseous helium is provided for liquefaction to enable various experimenters to work at low temperatures. Three major research programs currently using the bulk of this helium are: low-temperature solid-state studies; physical chemistry studies of the structure of inorganic molecules; and the development of dewars and detectors for infrared astrophysics.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, RESEARCH OF THE ULTRAVIOLET SPECTRA OF T TAURI AND RELATED STARS

C.L. IMHOFF, Univ. of Arizona, Graduate School, *Tucson, Arizona* 85721 (NSG 5235)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0002, DEVELOPMENT OF INSTRUMENTATION FOR AN EXTREME ULTRAVIOLET EXPLORER

C.S. BOWYER, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (NAS 5-24445)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0003, ISEE-C SPACECRAFT AND STANFORD SOLAR TELESCOPE

UNKNOWN, Stanford University, Graduate School, *Palo Alto, California* 94305 (NAS 5-24420)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0004, DYNAMIC OBSERVATIONS OF SOLAR MAGNETIC AND VELOCITY FIELDS

J.M. WILCOX, Stanford University, Inst. for Plasma Research, *Palo Alto, California* 94305 (ATM77-20580)

This grant will continue the integrated light measurements of the solar magnetic field made daily at the Stanford Solar Observatory. The instrument used is a Babcock-type magnetograph attached to a 23m vertical Littrow spectrograph. The mean field measurement represents a weighted average of the net magnetic field on the visible disk of the sun.

These observations of the mean solar magnetic field are now being shared with scientists throughout the world through publication in 'Solar-Geophysical Data', published by the National Oceanic and Atmospheric Administration and by the National Geophysical and Solar-Terrestrial Data Center in Boulder, Colorado.

The data will be used at Stanford to develop further the similarities between the observed properties of equatorial coronal holes and the solar magnetic sector structure. These similarities include rigid rotation, a lifetime of several solar rotations, the location of the equatorial coronal hole in the middle of a magnetic sector with an extent in latitude from one polar region to 25 or 30 degrees on the other side of the solar equator, and the geomagnetic enhancements associated with coronal holes and with the middle portion of solar magnetic sectors. Further investigations of the terrestrial effects of coronal holes will be pursued.

An attempt will be made to observe the so-called pulsations of the sun with a period of approximately 160 minutes. The overall aim is to study the sun as a star and elucidate the way in which it controls the terrestrial environment.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0005, THEORETICAL ASTROPHYSICS RESEARCH
P. GOLDREICH, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (AST76-24281 A01)

Theoretical investigations related to a variety of outstanding astrophysical problems will be carried out. These will include: the driving of density waves in galaxies, the dynamics of Saturn's rings, the formation of asteroids, satellites and planets, tidal evolution in binary star systems, the relation between OB associations and molecular clouds, and the origin of QSO absorption lines.

This is a continuation of grant AST 76-24281.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0006, OBSERVATIONS OF FAINT, HIGH-LATITUDE BLUE STARS AND ULTRAVIOLET SPECTROSCOPY OF PECULIAR GALAXIES AND QUASARS
J.L. GREENSTEIN, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (NSG 5243)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0007, FABRICATION AND ANALYSIS OF DIGICONS
E.A. BEAVER, Univ. of California, Graduate School, *San Diego, California* 92037 (NAS 5-24466)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0008, CONSULTIVE SERVICES FOR ASTRONOMICAL SPECTRA
A. HENINS, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (2320571 (NBS NO.))

PURPOSE: To provide quantitative spectrometric characterization of the crystal device to be flown in the Solar Maximum Mission, 1978.

OBJECTIVES: Development of the generalized optimization procedures to permit rational choice of the characteristics of crystals to be used in solar and astronomical spectroscopy. To improve NBS capabilities in the area of quantitative classifications of the dynamical behavior of nearly perfect crystals. To expand the laboratory capabilities at NBS for the characterization of the intrinsic properties of crystals as well as their performance under stress for focussing X-ray and gamma-ray instruments.

FY77 MILESTONES: 1. Final specifications of flight crystals for the Solar Maximum Mission, 1-77. 2. Receipt for an initial test of flight crystals, 1-77. 3. Establishment of dynamical theory programs on the NBS computer together with routine and convenient procedures for eliminating accidental double reflections, 1-77. 4. Provision for air and vacuum handling of extremely large bent crystals, 3-77. 5. Completion of quantitative tests, 9-77.

SUPPORTED BY Lockheed Aircraft Corp.

10.0009, NAVIGATION - ACCURATE POSITIONS OF SOLAR SYSTEM OBJECTS
R.S. HARRINGTON, U.S. Navy, Observatory, *Washington, District of Columbia* 20390 (DN046002)

Observations of solar system objects such as the planets, and satellites of planets, asteroids and comets constitute fundamental input to navigation, communication and celestial prediction in which the Naval Observatory has a Department of Defense-directed requirement.

Observational program is carried out with a 15-inch astrograph, a twin 8-inch astrograph, and 61-inch and 40-inch reflector telescopes to obt[in data on the positions and motions of comets, planets, planetary satellites, and a selected list of asteroids.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Observatory

10.0010, ANALYSIS OF COMETARY GAS AND DUST
J.S. NEFF, Univ. of Iowa, School of Liberal Arts, *Iowa City, Iowa* 52240 (NSG 7412)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0011, OBSERVATIONS OF THE ULTRAVIOLET SPECTRUM OF THE PECULIAR RADIO SOURCE OJ-287 AND RELATED OBJECTS
R.L. HACKNEY, Western Kentucky University, School of Science & Technology, *Bowling Green, Kentucky* 42101 (NSG 5238)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0012, SCIENTIFIC INVESTIGATIONS IN SUPPORT OF THE SPACE TELESCOPE PROJECT
W.G. FASTIE, Johns Hopkins University, School of Arts & Sciences, *Baltimore, Maryland* 21218 (NAS 8-32903)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0013, OBSERVATIONS AND THEORETICAL INVESTIGATIONS OF PULSARS
J.H. TAYLOR, Univ. of Massachusetts, School of Arts & Sciences, *Amherst, Massachusetts* 01002 (AST77-20019)

This project is designed to further our physical understanding of pulsars, to clarify our knowledge of the role played by pulsars in stellar evolution and to exploit the possibilities afforded by the binary pulsar PSR 1913 plus 16 as a testbed for gravitation theories. Efforts will fall into four basic categories: 1. The 300-foot telescope of the National Radio Astronomy Observatory will be used to survey the entire northern sky for previously undetected pulsars. 2. A program of observing fluctuations over sub-millisecond time scales in pulsar emissions will be continued. This work will be done at the Arecibo Observatory and will include a multi-frequency/multi-observatory project carried out in collaboration with groups using the Jodrell Bank 250-foot and Bonn 100-meter radio telescopes. 3. Observations of the binary pulsar PSR 1913 plus 16 will be upgraded and continued. Timing data have now been obtained at regular intervals since September 1974, and the overall time span is approaching the length required for important tests of gravitation theories. 4. Theoretical work involving the pulsar emission mechanism and the galactic distribution and kinematics of pulsars will continue in close cooperation with the observational work.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0014, INVESTIGATION OF INTERSTELLAR CARBON
J.H. BLACK, Univ. of Minnesota, School of Liberal Arts, *Minneapolis, Minnesota* 55455 (NSG 5237)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0015, BACKGROUND SKY BRIGHTNESS MEASUREMENTS FOR APPLICATION TO SPACE SURVEILLANCE SYSTEMS
J.L. WEINBERG, State University of New York, School of Arts & Sciences, *Albany, New York* 12222 (DF044830; AF-AFOSR-3091-76)

AF function - space surveillance activities require a specific knowledge of the background sky brightness in visible and IR wavelength regions. Deficiency - no definitive measurement exists of the background brightness outside the earth's atmosphere. Objective - to determine the sky brightness due to zodiacal light and gegenschein. Data from spacecraft Pioneer 10 and 11 will be used. Contributions - the sky brightness in two spectral bands in the visual will be determined for the entire celestrial sphere. These results will contribute to knowledge of the sky brightness in the IR region.

Data exists for measurements from the earth's orbit to beyond Jupiter's orbit. Preliminary results have shown that emission due to zodiacal light and gegenschein is greatly reduced beyond the asteroid belt. The background of interstellar space will serve as a control for determining the absolute emission of the zodiacal light and gegenschein. These measurements have been made in two spectral regions in the visible. These measurements plus polarization measurements will reveal the distribution and composition of the interplanetary dust thus providing a model for emission to all wavelengths.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

10.0016, INTERACTIONS OF PLANETARY SATELLITES - THE CAPTURE AND TIDAL ACCELERATION OF MOONS, AND THE DYNAMICS OF CIRCUMPLANETARY DUST
J.A. BURNS, Cornell University, School of Engineering, *Ithaca, New York* 14850 (NCA 2-17580)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0017, ORBITAL THEORIES OF OUTER PLANET SATELLITES
W.H. JEFFERYS, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (NSG 7408)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0018, HIGH BRIGHTNESS QUASARS - SAS-3
B.K. DENNISON, Virginia Poly. Inst. & St. U., Graduate School, *Blacksburg, Virginia* 24061 (NSG 5221)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0019, HIGH-RESOLUTION SPECTRAL OBSERVATIONS - IUE
L.R. DOHERTY, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (NSG 5242)

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N78-24042# Defense Systems Management School, Fort Belvoir, Va.
THREE DEGREE INTERMEDIATE LEVEL MAINTENANCE OF NAVY AERONAUTICAL MATERIALS
Robert Edward Bates, Jr. 9 Nov. 1977 79 p refs
(AD-A052389) Avail: NTIS HC A05/MF A01 CSCL 01/5

This report discusses the development, implementation and impact of the concept of three degree maintenance relative to the traditional maintenance policy of three levels of maintenance for Navy aeronautical materials. An additional management tool specifically designed to supplement efforts directed towards improving the maintenance support posture of aeronautical materials at the intermediate level of maintenance results from the development of three degree maintenance concept. A formal methodology is provided to supplement management capability on an individual equipment/component basis to: (1) classify maintenance functions within levels and by activity; (2) assign maintenance responsibility to a specific level and activity; (3) assign maintenance tasks consistent with complexity, depth, scope, and range of work to be performed; and (4) ensure optimum use of limited resources. Author (GRA)

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N78-24043*# Rockwell International Corp., Los Angeles, Calif.
AERODYNAMIC PRELIMINARY ANALYSIS SYSTEM. PART 2: USER'S MANUAL AND PROGRAM DESCRIPTION
P. Divan, K. Dunn, and J. Kojima Apr. 1978 192 p
(Contract NAS1-14686)
(NASA-CR-145300) Avail: NTIS HC A09/MF A01 CSCL 01A

A comprehensive aerodynamic analysis program based on linearized potential theory is described. The solution treats thickness and attitude problems at subsonic and supersonic speeds. Three dimensional configurations with or without jet flaps having multiple nonplanar surfaces of arbitrary planform and open or closed slender bodies or noncircular contour are analyzed. Longitudinal and lateral-directional static and rotary derivative solutions are generated. The analysis is implemented on a time sharing system in conjunction with an input tablet digitizer and an interactive graphics input/output display and editing terminal to maximize its responsiveness to the preliminary analysis problem. Nominal case computation time of 45 CPU seconds on the CDC 175 for a 200 panel simulation indicates the program provides an efficient analysis for systematically performing various aerodynamic configuration tradeoff and evaluation studies. Author

N78-24044*# Aeronautical Research Associates of Princeton, Inc., N. J.
ATMOSPHERIC-WAKE VORTEX INTERACTIONS
Alan J. Bilanin, Joel E. Hirsh, Milton E. Teske, and Arthur M. Hecht Apr. 1978 61 p refs
(Contract NAS1-14707)
(NASA-CR-145336; ARAP-331) Avail: NTIS HC A04/MF A01 CSCL 01A

The interactions of a vortex wake with a turbulent stratified atmosphere are investigated with the computer code WAKE. It is shown that atmospheric shear, turbulence, and stratification can provide the dominant mechanisms by which vortex wakes decay. Computations included the interaction of a vortex wake with a viscous ground plane. The observed phenomenon of vortex bounce is explained in terms of secondary vorticity produced on the ground. This vorticity is swept off the ground and advected about the vortex pair, thereby altering the classic hyperbolic trajectory. The phenomenon of the solitary vortex is explained as an interaction of a vortex with crosswind shear. Here, the vortex having the sign opposite that of the sign of the vorticity in the shear is dispersed by a convective instability. This instability results in the rapid production of turbulence which in turn disperses the smoke marking the vortex. Author

N78-24045*# Mississippi State Univ., Mississippi State. Dept. of Aerophysics and Aerospace Engineering.
NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR BLUNT NOSED BODIES IN SUPERSONIC FLOWS Final Report
Z. U. A. Warsi, Krishna DeVarayalu, and J. F. Thompson May 1978 67 p refs
(Grant NsG-1242)
(NASA-CR-157053; MSSU-EIRS-ASE-78-1) Avail: NTIS HC A04/MF A01 CSCL 01A

A time dependent, two dimensional Navier-Stokes code employing the method of body fitted coordinate technique was developed for supersonic flows past blunt bodies of arbitrary shapes. The bow shock ahead of the body is obtained as part of the solution, viz., by shock capturing. A first attempt at mesh refinement in the shock region was made by using the forcing function in the coordinate generating equations as a linear function of the density gradients. The technique displaces a few lines from the neighboring region into the shock region. Numerical calculations for Mach numbers 2 and 4.6 and Reynolds numbers from 320 to 10,000 were performed for a circular cylinder with and without a fairing. Results of Mach number 4.6 and Reynolds number 10,000 for an isothermal wall temperature of 556 K are presented in detail. Author

N78-24046*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
POWERED-LIFT AERODYNAMICS AND ACOUSTICS
Washington 1976 502 p refs Conf. held at Hampton, Va., 24-26, May 1976

(NASA SP-406) Avail: NTIS HC A22/MF A01 CSCL 01A

Powered lift technology is reviewed. Topics covered include: (1) high lift aerodynamics; (2) high speed and cruise aerodynamics; (3) acoustics; (4) propulsion aerodynamics and acoustics; (5) aerodynamic and acoustic loads; and (6) full-scale and flight research. For individual titles, see N78-24047 through N78-24076.

N78-24047*# Joint Inst. for Acoustics and Flight Sciences, Hampton, Va.

OVERVIEW OF POWERED-LIFT TECHNOLOGY

John P. Campbell *In* NASA. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 1-27 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

The concept and application of powered lift and the effects of some fundamental design variables are discussed. A brief chronology of significant developments in the field is also presented and the direction of research efforts in recent years is indicated. All powered lift concepts are included, but emphasis is on the two externally blown schemes which involve blowing either above or below the wing and which are utilized in the YC-14 and YC-15 aircraft. Aerodynamics and vehicle design are emphasized. The areas of acoustics, propulsion, and loads are briefly considered. Author

N78-24048*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

UPPER-SURFACE-BLOWING FLOW-TURNING PERFORMANCE

William C. Sleeman, Jr. and Arthur E. Phelps, III (Army Air Mobility R and D Lab., Hampton, Va.) *In its* Powered-Lift Aerodyn. and Acoustics 1976 p 29-43 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

Jet exhaust flow-turning characteristics were determined for systematic variations in upper-surface blowing exhaust nozzles and trailing-edge flap configuration variables from experimental wind-off (static) flow studies. For conditions with parallel flow exhausting from the nozzle, jet height (as indicated by nozzle exit height) and flap radius were found to be the most important parameters relating to flow turning. Nonparallel flow from the nozzle, as obtained from an internal roof angle and/or side spread angle, had a large favorable effect on flow turning. Comparisons made between static turning results and wind tunnel aerodynamic studies of identical configurations indicated that static flow-turning results can be indicative of wind-on powered lift performance for both good and poor nozzle-flap combinations but, for marginal designs, can lead to overly optimistic assessment of powered lift potential. Author

N78-24049*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

RESULTS OF STATIC TESTS OF A 1/4 SCALE MODEL OF THE BOEING YC-14 POWERED-LIFT SYSTEM

James L. Hassell, Jr. *In its* Powered-Lift Aerodyn. and Acoustics 1976 p 45-62 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

One quarter scale static ground tests of the Boeing YC-14 powered lift system were conducted for correlation with full scale test results. The 1/4 scale model utilized a JT-15D turbofan engine to represent the CF6-50D engine employed on the YC-14 advanced medium STOL transport prototype aircraft. The tests included evaluation of static turning performance, static surface pressure and temperature distributions, fluctuating loads, and accelerations of portions of the wing, flaps, and fuselage. Results are presented for the landing flap configuration over an appropriate range of fan pressure ratio as affected by several variables including ground height and vortex generator modifications. Static turning angles of the order of 60 deg were obtained. The highest surface pressures and temperatures were concentrated over the upper surface of the flaps in the region immediately aft of the upper surface blown nozzle. Author

N78-24050*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SUMMARY OF LOW-SPEED AERODYNAMIC CHARACTERISTICS OF UPPER-SURFACE-BLOWN JET-FLAP CONFIGURATIONS

Arthur E. Phelps, III (Army Air Mobility R and D Lab., Hampton, Va.), Joseph L. Johnson, Jr., and Richard J. Margason *In its* Powered-Lift Aerodyn. and Acoustics 1976 p 63-87 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

The results of recent wind tunnel investigations to provide fundamental information on the upper surface blown (USB) jet flap concept demonstrated that the USB concept provides good high-lift performance. It is shown that the low speed performance is dependent upon the jet turning angle and turning efficiency and on the use of proper leading and trailing edge treatment to prevent premature flow separation. The best means of achieving good turning performance in any particular USB application must be determined from overall operational considerations in which high speed performance, structures and noise, as well as low speed performance, are evaluated. The large diving moments generated at high lift coefficients can be trimmed satisfactorily with a large, conventional horizontal tail; a high tail position is best from longitudinal stability considerations. Large rolling and yawing moments are introduced with the loss of an engine, but these moments can be trimmed satisfactorily through the use of asymmetrical boundary layer control and through the use of spoiler and rudder deflection as needed. Author

N78-24051*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

APPLICATION OF POWERED-LIFT CONCEPTS FOR IMPROVED CRUISE EFFICIENCY OF LONG-RANGE AIRCRAFT

Paul L. Coe, Jr. and Paul G. Fournier *In its* Powered-Lift Aerodyn. and Acoustics 1976 p 89-101 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

Results of studies conducted to explore the use of powered lift concepts for improved low speed performance of long range subsonic and supersonic cruise vehicles are summarized. It is indicated that powered lift can provide significant improvements in low speed performance, as well as substantial increases in cruise efficiency and range for both subsonic and supersonic cruise configurations. Author

N78-24052*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

COMPARISON OF AERODYNAMIC THEORY AND EXPERIMENT FOR JET-FLAP WINGS

Thomas G. Gainer, Long P. Yip, and Raymond P. Vogler *In its* Powered-Lift Aerodyn. and Acoustics 1976 p 103-118 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

Aerodynamic theory predictions made for a jet flapped wing were compared with experimental data obtained in a fairly extensive series of tests in the Langley V/STOL tunnel. The tests were made on a straight, rectangular wing and investigated two types of jet flap concepts: a pure jet flap with high jet deflection and a wing with blowing at the knee of a plain trailing edge flap. The tests investigated full and partial span blowing for wing aspect ratios of 8.0 and 5.5 and momentum coefficients from 0 to about 4. The total lift, drag, and pitching moment coefficients predicted by the theory were in excellent agreement with experimental values for the pure jet flap, even with the high jet deflection. The pressure coefficients on the wing, and hence the circulation lift coefficients, were underpredicted, however, because of the linearizing assumptions of the planar theory. The lift, drag, and pitching moment coefficients, as well as pressure coefficients, were underpredicted for the wing with blowing over the flap because of the failure of the theory to account for the interaction effect of the high velocity jet passing over the flap. Author

N78-24053*# Army Air Mobility Research and Development Lab., Hampton, Va.

EXTERNALLY BLOWN FLAP IMPINGEMENT PARAMETERS

Danny R. Hoad *In* NASA. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 119-134 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

The performance of two externally blown flap (EBF) wind tunnel models was compared with an engine exhaust flap impingement correlation parameter. One model was a four engine EBF triple slotted flap transport. Isolated engine wake surveys were conducted to define the wake properties of five separate engine configurations for which performance data were available. The other model was a two engine EBF transport for which the engine wake properties were estimated. The correlation parameter was a function of engine exhaust dynamic pressure at the flap location, area of engine exhaust flap impingement, total exhaust area at the flap location, and engine thrust. The distribution of dynamic pressure for the first model was measured; however, the distribution for the second model was assumed to be uniform. Author

N78-24054*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SOME MEASUREMENTS OF AN EBF POWERED-LIFT WAKE

William G. Johnson, Jr. *In its* Powered-Lift Aerodyn. and Acoustics 1976 p 135-143 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

Results from a wind tunnel investigation in which velocity vector measurements were obtained in the near wake of an externally blown flap powered lift configuration were analyzed. These measurements were used to develop spanwise distributions for the momentum strength and location of the engine exhaust stream tube with the results used as input parameters to one jet flap analytical method. It is shown that a comparison of the momentum coefficients obtained from forward speed wake surveys with the predicted values from static force data results in a good correlation, which verifies the use of the flap thrust recovery factor as a means of predicting the momentum strength at the flap trailing edge. Also, when wake survey distributions of momentum strength and direction are used as input parameters to one analytical jet flap method, the results show reasonable agreement between the experimental data and analytical results. Author

N78-24055*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AERODYNAMIC CHARACTERISTICS IN GROUND PROXIMITY

James L. Thomas, James L. Hassell, Jr., and Luat T. Nguyen *In its* Powered-Lift Aerodyn. and Acoustics 1976 p 145-158 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

Results from recent investigations in the Langley V/STOL tunnel of an externally blown flap and an upper surface blown flap configuration in ground proximity are presented. Comparisons of longitudinal aerodynamic characteristics indicate that in ground proximity, drag is reduced for both configurations, but changes in lift are configuration dependent. Steady state analyses of the landing approach indicate an increase in flight path angle for both configurations in ground proximity because of the drag reduction. Dynamic analyses with a fixed-base simulator indicate that the resultant flight path during landing approach is dependent on the initial flight path angle and the control technique used. Author

N78-24056*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DISTRIBUTED UPPER-SURFACE BLOWING CONCEPT

Paul G. Fournier and Paul L. Coe, Jr. *In its* Powered-Lift Aerodyn. and Acoustics 1976 p 159-164 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

A low speed investigation was conducted in the Langley V/STOL tunnel to determine the powered lift aerodynamic performance of a distributed upper surface blown propulsive lift transport model. The model used blowing slots across the span of the wing to produce a thin jet efflux near the leading edge and at the knee of the trailing edge flap (internally blown jet flap). Results indicate that these concepts have both good propulsive related lift and low drag due to lift characteristics because of uniform spanwise propulsive thrust. The leading edge blowing concept provides low speed lift characteristics which are competitive with the flap-hinge-line blowing concept and does not require additional leading edge treatment for prevention of abrupt stall. Author

N78-24057*# Lockheed-Georgia Co., Marietta.

CRUISE AERODYNAMICS OF USB NACELLE/WING GEOMETRIC VARIATIONS

John A. Braden, John P. Hancock, and Kenneth P. Burdges *In* Nasa. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 165-181 (For availability see N78-24046 15-02)

(Contract NAS1-13871)

Avail: NTIS HC A22/MF A01 CSCL 01A

Experimental results are presented on aerodynamic effects of geometric variations in upper surface blown nacelle configurations at high speed cruise conditions. Test data include both force and pressure measurements on two and three dimensional models powered by upper surface blowing nacelles of varying geometries. Experimental results are provided on variations in nozzle aspect ratio, nozzle boattail angle, and multiple nacelle installations. The nacelles are ranked according to aerodynamic drag penalties as well as overall installed drag penalties. Sample effects and correlations are shown for data obtained with the pressure model. Author

N78-24058*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECTS OF NOZZLE DESIGN AND POWER ON CRUISE DRAG FOR UPPER-SURFACE-BLOWING AIRCRAFT

Edward T. Meleason *In* NASA. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 183-196 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

A high speed wind tunnel investigation was conducted on a series of upper surface blowing nozzles with D-shaped exits installed on a representative short haul aircraft model. Both two and four engine configurations were investigated. Powered engine simulators were used to properly represent nacelle flows. Large differences in cruise drag penalties associated with the various nozzle designs were seen. Some geometric parameters influencing nozzle cruise drag are identified. Author

N78-24059*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THEORETICAL PREDICTIONS OF JET INTERACTION EFFECTS FOR USB AND OWB CONFIGURATIONS

C. Edward Lan (Kansas Univ.) and James F. Campbell *In its* Powered-Lift Aerodyn. and Acoustics 1976 p 197-211 refs (For availability see N78-24046 15-02)

(Grant NsG-1139)

Avail: NTIS HC A22/MF A01 CSCL 01A

A wing jet interaction theory is presented for predicting the aerodynamic characteristics of upper surface blowing and over wing blowing configurations. For the latter configurations, a new jet entrainment theory is developed. Comparison of predicted results with some available data showed good agreement. Some applications of the theory are also presented. Author

N78-24060*# Lockheed-Georgia Co., Marietta.

USB FLOW CHARACTERISTICS RELATED TO NOISE GENERATION

W. H. Brown and N. N. Reddy *In* NASA. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 213-226 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

The effects of nozzle and flap geometry on upper surface blown flow field characteristics related to noise generation were examined experimentally using static models. Flow attachment and spreading characteristics were observed using flow visualization techniques. Velocity and turbulence profiles in the trailing edge wake were measured using hot-wire anemometry, and the effects of the geometric variables on peak velocity and turbulence intensity were determined. It is shown that peak trailing edge velocity is a function of the ratio of flow length to modified hydraulic diameter. Author

N78-24061*# Lockheed-Georgia Co., Marietta.

CHARACTERISTICS OF USB NOISE

J. S. Gibson and N. Searle *In* NASA. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 227-239 (For

availability see N78-24046 15-02)
(Contract NAS1-13870)
Avail: NTIS HC A22/MF A01 CSCL 01A

An extensive series of noise measurements, for a variety of geometric and operational parameters, was made on models of upper surface blowing (USB) powered lift systems. The data obtained were analyzed and the effects and trends of parametric variation defined. The behavior and nature of USB noise and the design of USB systems with low noise characteristics is examined. Author

N78-24062*# Lockheed-Georgia Co., Marietta.
ANALYTICAL DEVELOPMENTS FOR DEFINITION AND PREDICTION OF USB NOISE
N. N. Reddy and C. K. W. Tam *In* NASA. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 241-262 refs (For availability see N78-24046 15-02)
(Contract NAS1-13870)
Avail: NTIS HC A22/MF A01 CSCL 01A

A systematic acoustic data base and associated flow data are used in identifying the noise generating mechanisms of upper surface blown flap configurations of short takeoff and landing aircraft. Theory is developed for the radiated sound field of the highly sheared flow of the trailing edge wake. An empirical method is also developed using extensive experimental data and physical reasonings to predict the noise levels. Author

N78-24063*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL MODELING OF UNDER-THE-WING EXTERNALLY BLOWN FLAP POWERED-LIFT NOISE
Daniel J. McKinzie, Jr. *In* NASA. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 263-282 refs (For availability see N78-24046 15-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

The sound field produced by the interaction of a subsonic jet with a large-scale model of the under the wing externally blown flap in an approach attitude was analyzed. The analysis was performed to obtain a better understanding of the dominant noise sources and the mechanisms governing the peak sound pressure level frequencies of the broadband spectra. An analytical expression is derived which incorporates two available theories and experimental data; the expression predicts the sound field along a circular arc of approximately 120 deg measured from the upstream jet axis in the fly-over plane. The analysis compares favorably with test results obtained from two large-scale models, one using cold air from a conical nozzle and the other using hot gas from a TF-34 turbofan engine having a conical exhaust nozzle with a 12 lobe internal forced mixer. The frequency at which the peak sound pressure level occurs appears to be governed by a phenomenon which produces periodic formation and shedding of large-scale turbulence structures from the nozzle lip. Author

N78-24064*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
USB NOISE REDUCTION BY NOZZLE AND FLAP MODIFICATIONS
Richard E. Hayden *In* NASA. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 283-305 refs (For availability see N78-24046 15-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

The development of concepts for reducing upper surface blown flap noise at the source through flap modifications and special nozzles is reviewed. In particular, recent results obtained on the aerodynamic and acoustic performance of flaps with porous surfaces near the trailing edge and multi-slotted nozzles are reviewed. Considerable reduction (6-10 db) of the characteristic low frequency peak is shown. The aerodynamic performance is compared with conventional systems, and prospects for future improvements are discussed. Author

N78-24065*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass
EBF NOISE REDUCTION THROUGH NOZZLE/FLAP POSITIONING
Y. Kadman and K. L. Chandiramani *In* NASA. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 307-324 refs Sponsored by NASA (For availability see N78-24046 15-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

Results are presented of an experimental and analytical study of the dependence of externally blown flap (EBF) noise on the relative position and shape of engine exhaust nozzle. Tests, conducted on a 1/15 scale model of a triple-slotted EBF system, indicate that a significant reduction (of up to 10 to 15 db for no forward speed case and of up to 5 to 10 db for forward speed case) is possible in the low frequency (around 63 Hz) region of the noise spectrum of the full scale device for small nozzle/flap separation distances. The overall acoustic performance, measured in PNdb, does not exhibit significant reductions. The analysis of the EBF noise is carried out for two limiting airfoil in a free jet. The analytical results also suggest that low frequency noise can be reduced by placing the nozzle close to the flow turning elements. Author

N78-24066*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OVERVIEW OF THE QCSEE PROGRAM
Carl C. Ciepluch *In* NASA. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 325-333 refs (For availability see N78-24046 15-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

Externally blown flap and upper surface blown flap powered lift concepts were investigated in the Quiet Clean Short-Haul Experimental Engine Program and briefly discussed along with propulsion system requirements. Noise limits, emission standards, thrust requirements, and thrust-to-weight ratios are among the factors considered. J.M.S.

N78-24067*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACOUSTIC DESIGN OF THE QCSEE PROPULSION SYSTEMS
Irvin J. Loeffler, Edward B. Smith (GE Co., Fairfield, Conn.), and Harry D. Sowers (GE Co., Fairfield, Conn.) *In* NASA. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 335-356 refs (For availability see N78-24046 15-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

Acoustic design features and techniques employed in the Quiet Clean Short-Haul Experimental Engine (QCSEE) Program are described. The role of jet/flap noise in selecting the engine fan pressure ratio for powered lift propulsion systems is discussed. The QCSEE acoustic design features include a hybrid inlet (near-sonic throat velocity with acoustic treatment); low fan and core pressure ratios; low fan tip speeds; gear-driven fans; high and low frequency stacked core noise treatment; multiple-thickness treatment; bulk absorber treatment; and treatment on the stator vanes. The QCSEE designs represent and anticipated acoustic technology improvement of 12 to 16 PNdb relative to the noise levels of the low-noise engines used on current wide-body commercial jet transport aircraft. Author

N78-24068*# General Electric Co., Philadelphia, Pa.
INLET/NACELLE/EXHAUST SYSTEM INTEGRATION FOR THE QCSEE PROPULSION SYSTEMS
John T. Kutney *In* NASA. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 357-367 (For availability see N78-24046 15-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

The key features of the integrated propulsion systems developed for short haul aircraft are discussed including the high Mach number, fixed geometry, near sonic inlet, the variable area nozzles, thrust reversing systems, and aircraft accessory location. The roles and interplay of each element are considered and comparisons are made with conventional state-of-the-art technology. Author

N78-24069*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INLET TECHNOLOGY FOR POWERED-LIFT AIRCRAFT
Roger W. Luidens *In* NASA. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 369-385 refs (For availability see N78-24046 15-02)
Avail: NTIS HC A22/MF A01 CSCL 01A

The concepts, analytical tools, and experimental data available for designing inlets for powered lift aircraft are discussed. It is

shown that inlets can be designed to meet noise, distortion, and cruise drag requirements at the flight and engine operating conditions of a powered lift aircraft. The penalty in pressure recovery for achieving the required noise suppression was 0.3 percent. Author

N78-24070*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

REVERSE-THRUST TECHNOLOGY FOR VARIABLE-PITCH FAN PROPULSION SYSTEMS

David A. Sagerser, John W. Schaefer, and Donald A. Dietrich *In* NASA. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 387-402 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

Tests conducted to develop the technology necessary to meet the unique reverse-thrust performance requirements of a variable pitch fan propulsion system are discussed. The losses and distortion associated with the air entering the fan and core compressor from the rear of the engine, the direction of fan blade pitch rotation for best reverse-thrust aeroacoustic performance, and engine response and operating characteristics during forward- to reverse-thrust transients are among the factors studied. The test results of several scale fan models as well as a full-size variable pitch fan engine are summarized. Results show the following: a flared exhaust nozzle makes a good reverse-thrust inlet; acceptable core inlet duct recovery and distortion levels in reverse flow were demonstrated; adequate thrust levels were achieved; forward- to reverse-thrust response time achieved was better than the goal; thrust and noise levels strongly favor reverse through feather pitch; and finally, flight-type inlets make the establishment of reverse flow more difficult. Author

N78-24071*# General Electric Co., Philadelphia, Pa.

ACOUSTICS AND AERODYNAMICS OF OVER-THE-WING THRUST REVERSERS

Dale L. Stimpert and Robert C. Ammer *In* NASA. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 403-414 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

As part of the Quiet Clean Short-Haul Experimental Engine Program, model tests were conducted to determine the effects of thrust reverser geometric parameters on noise and reverse thrust. The acoustic tests used a 1/6 scale model thrust reverser while the aerodynamic performance tests used a 1/12 scale model reverser. Parameters which were varied in both tests include blocker spacing, blocker height, lip angle, and lip length. The impact of these parameters on peak sideline noise and reverse thrust performance is discussed. Author

N78-24072*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MEASURED AND CALCULATED STEADY AERODYNAMIC LOADS ON A LARGE-SCALE UPPER-SURFACE BLOWN MODEL

Boyd Perry, III and Michael R. Mendenhall (Nielsen Engineering and Res., Inc., Mountain View, Calif.) *In its* Powered-Lift Aerodyn. and Acoustics 1976 p 415-428 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

Static aerodynamic loads measurements from wind tunnel tests of a full-scale upper surface blown jet flap configuration are presented. The measured loads are compared with calculations using a method for predicting longitudinal aerodynamic characteristics of upper surface blown jet flap configurations. Author

N78-24073*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ACOUSTIC-LOADS RESEARCH FOR POWERED-LIFT CONFIGURATIONS

James A. Schoenster, Conrad M. Willis, James C. Schroeder, and John S. Mixson *In its* Powered-Lift Aerodyn. and Acoustics 1976 p 429-443 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

Data presented from large-scale model tests with jet engines having thrusts of 9 kN (2000 lb) and 36 kN (8000 lb) include acoustic loads for an externally blown wing and flap induced by a TF34 jet engine, an upper surface blown (USB) aircraft model in a wind tunnel, and two USB models in static tests. Comparisons of these results with results from acoustic loads studies on configurations of other sizes are made and the implications of these results on interior noise and acoustic fatigue are discussed. Author

N78-24074*# Virginia Univ., Charlottesville.

INVESTIGATIONS OF SCALING LAWS FOR JET IMPINGEMENT

J. B. Morton, J. K. Haviland, G. D. Catalano, and W. W. Herling *In* NASA. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 445-463 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

The statistical properties of tangential flows over surfaces were investigated by two techniques. In one, a laser-Doppler velocimeter was used in a smoke-laden jet to measure one-point statistical properties, including mean velocities, turbulent intensities, intermittencies, autocorrelations, and power spectral densities. In the other technique, free stream and surface pressure probes connected to 1/8 inch microphones were used to obtain single point rms and 1/3 octave pressures, as well as two point cross correlations, the latter being converted to auto spectra, amplitude ratios, phase lags, and coherences. The results of these studies support the vortex model of jets, give some insights into the effects of surface impingement, and confirm that jet diameter and velocity are the scaling parameters for circular jets, while Reynolds number is relatively unimportant. Author

N78-24075*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

NASA PARTICIPATION IN THE AMST PROGRAM

Earl J. Montoya and Alan E. Faye, Jr. (NASA. Ames Res. Center) *In* NASA. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 465-478 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

The objectives of the NASA Advanced Medium STOL Transport Experiments Program are discussed and several of the NASA experiments currently implemented and conducted on the YC-14 and YC-15 prototype aircraft are described. Emphasis is placed on experiments related to powered lift aerodynamics and acoustics. Author

N78-24076*# Boeing Co., Seattle, Wash.

USB ENVIRONMENT MEASUREMENTS BASED ON FULL-SCALE STATIC ENGINE GROUND TESTS

M. B. Sussman, D. L. Harkonen, and J. B. Reed *In* NASA. Langley Res. Center Powered-Lift Aerodyn. and Acoustics 1976 p 479-496 refs (For availability see N78-24046 15-02)

Avail: NTIS HC A22/MF A01 CSCL 01A

Flow turning parameters, static pressures, surface temperatures, surface fluctuating pressures and acceleration levels were measured in the environment of a full-scale upper surface blowing (USB) propulsive lift test configuration. The test components included a flightworthy CF6-50D engine, nacelle, and USB flap assembly utilized in conjunction with ground verification testing of the USAF YC-14 Advanced Medium STOL Transport propulsion system. Results, based on a preliminary analysis of the data, generally show reasonable agreement with predicted levels based on model data. However, additional detailed analysis is required to confirm the preliminary evaluation, to help delineate certain discrepancies with model data, and to establish a basis for future flight test comparisons. Author

N78-24077*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TABULATED PRESSURE MEASUREMENTS OF A NASA SUPERCRITICAL-WING RESEARCH AIRPLANE MODEL WITH AND WITHOUT FUSELAGE AREA-RULE ADDITIONS AT MACH 0.25 TO 1.00

Charles D. Harris and Dennis W. Bartlett Dec. 1972 263 p refs

(NASA-TM-X-2634; L-8443) Avail: NTIS HC A12/MF A01 CSCL 01A

Basic pressure measurements were made on a 0.087-scale model of a supercritical wing research airplane in the Langley 8 foot transonic pressure tunnel at Mach numbers from 0.25 to

1.00 to determine the effects on the local aerodynamic loads over the wing and rear fuselage of area-rule additions to the sides of the fuselage. In addition, pressure measurements over the surface of the area-rule additions themselves were obtained at angles of sideslip of approximately - 5 deg, 0 deg, and 5 deg to aid in the structural design of the additions. Except for representative figures, results are presented in tabular form without analysis. Author

N78-24078*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND-TUNNEL INVESTIGATION OF BASIC AERODYNAMIC CHARACTERISTICS OF A SUPERCRITICAL-WING RESEARCH AIRPLANE CONFIGURATION

Dennis W. Bartlett and Richard J. Re Washington Feb. 1972 109 p refs

(NASA-TM-X-2470; L-7979) Avail: NTIS HC A06/MF A01 CSCL 01A

Transonic pressure tunnel and transonic tunnel tests were performed to determine the aerodynamic characteristics of a 0.087 scale model of a supercritical wing research airplane configuration at Mach numbers from 0.25 to 1.30. The investigation included tests to determine the basic longitudinal aerodynamic characteristics, the lateral-directional aerodynamic characteristics for sideslip angles of 0 deg and + or - 2.5 deg, and the effects of Reynolds number and aeroelasticity. Author

N78-24079*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND-TUNNEL MEASUREMENTS OF AERODYNAMIC LOAD DISTRIBUTION ON AN NASA SUPERCRITICAL-WING RESEARCH AIRPLANE CONFIGURATION

Charles D. Harris Washington Feb. 1972 226 p refs

(NASA-TM-X-2469; L-7982) Avail: NTIS HC A11/MF A01 CSCL 01A

Wind tunnel tests have been conducted on a research airplane model with an NASA supercritical wing to define the general character of the flow over the wing and to aid in structural design of the full scale airplane. Pressure measurements were made at Mach numbers from 0.25 to 1.30 for sideslip angles from -2.50 deg to 2.50 deg over a moderate range of angles of attack and dynamic pressures. Except for representative figures, the results are presented in tabular form without detailed analysis. Author

N78-24080*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AERODYNAMIC CHARACTERISTICS OF AN NASA SUPERCRITICAL-WING RESEARCH AIRPLANE MODEL WITH AND WITHOUT FUSELAGE AREA-RULE ADDITIONS AT MACH 0.25 TO 1.00

Dennis W. Bartlett and Charles D. Harris Washington Dec. 1972 133 p refs

(NASA-TM-X-2633; L-8422) Avail: NTIS HC A07/MF A01 CSCL 01A

Transonic pressure tunnel tests at Mach numbers from 0.25 to 1.00 were performed to determine the effects of area-rule additions to the sides of the fuselage on the aerodynamic characteristics of a 0.087 scale model of an NASA supercritical-wing research airplane. Presented are the longitudinal aerodynamic force and moment characteristics for horizontal-tail deflection angles of -2.5 deg and -5 deg with the side fuselage area-rule additions on and off the model. The effects of the side fuselage area-rule additions on selected wing and fuselage pressure distributions at near-cruise conditions are also presented. Author

N78-24081*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF THE PROPERTIES OF A POROUS COATING ON BOUNDARY LAYER STABILITY

S. A. Gaponov May 1978 6 p refs Transl. into ENGLISH from Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Tekh. Nauk (USSR), no. 1, 1971 p 21-23 Original language document was announced as A72-22408 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.

(Contract NASw-2791)

(NASA-TM-75235) Avail: NTIS HC A02/MF A01 CSCL 01A

Drawing off gas from the boundary layer is a well-known method for increasing the stability of boundary layers. The increase in stability is primarily connected with a change in the velocity profile form in the case of suction. On the basis of the assumption that the velocity perturbations on a porous slate do not equal zero, the influence of the properties of a permeable surface upon the boundary layer stability were studied. Author

N78-24082*# National Aeronautics and Space Administration, Washington, D. C.

THEORETICAL INVESTIGATION OF MAINTAINING THE BOUNDARY LAYER OF REVOLUTION LAMINAR USING SUCTION SLITS IN INCOMPRESSIBLE FLOW

Peter Thiede Jun. 1978 107 p refs Transl. into ENGLISH from VDI-Z Fortschr.-Ber., Reihe 7, Stromungstech. (West Ger.), no. 27, Nov. 1970 115 p Original language document was announced as A72-19737 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.

(Contract NASw-2791)

(NASA-TM-75239) Avail: NTIS HC A06/MF A01 CSCL 01A

The transition of the laminar boundary layer into the turbulent state, which results in an increased drag, can be avoided by sucking of the boundary layer particles near the wall. The technically-interesting case of sucking the particles using individual slits is investigated for bodies of revolution in incompressible flow. The results of the variational calculations show that there is an optimum suction height, where the slot separations are maximum. Combined with favorable shaping of the body, it is possible to keep the boundary layer over bodies of revolution laminar at high Reynolds numbers using relatively few suction slits and small amounts of suction flow. Author

N78-24083*# National Aeronautics and Space Administration, Washington, D. C.

SUMMARY OF EXPERIMENTALLY DETERMINED FACTS CONCERNING THE BEHAVIOR OF THE BOUNDARY LAYER AND PERFORMANCE OF BOUNDARY LAYER MEASUREMENTS

W. vanNess Apr. 1978 15 p refs Transl. into ENGLISH from Luftfahrt-forschungsberichte des Bundesministers fuer Verkehr, no. 1, 1959 p 5-7 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by the Engineering Office for Lightweight Construction and Flow Technology, Duisburg, West Germany.

(Contract NASw-2790)

(NASA-TM-75270) Avail: NTIS HC A02/MF A01 CSCL 01A

A summary report of boundary layer studies is presented. Preliminary results of experimental measurements show that: (1) A very thin layer (approximately 0.4 mm) of the boundary layer seems to be accelerated; (2) the static pressure of the outer flow does not remain exactly constant through the boundary layer; and (3) an oncoming boundary layer which is already turbulent at the suction point can again become laminar behind this point without being completely sucked off. Author

N78-24084*# National Aeronautics and Space Administration, Washington, D. C.

INVESTIGATIONS OF THE INFLUENCE OF THE PROFILE THICKNESS OF THE COMPRESSIBLE PLANE FLOW THROUGH COMPRESSOR CASCADES

Jurgen Bahr Apr. 1978 31 p refs Transl. into ENGLISH from Forsch. Ingenieurw. (West-Germany), v. 30, no. 1, 1964 p 14-25 Transl. by SCITRAN, Santa Barbara, Calif.

(Contract NASw-2791)

(NASA-TM-75277) Avail: NTIS HC A03/MF A01 CSCL 01A

Flow-through cascade of an aircraft turbine compressor is studied experimentally over wide range of Reynolds numbers and subsonic Mach numbers; it was found that deterioration of flow properties due to decreasing Reynolds numbers is less noticeable on thin profiles than on thick ones; however, thick profiles are advantageous in compressors designed for efficient partial load behavior because thick profiles have a relatively large range of usable inlet flow angles. Author

N78-24085*# National Aeronautics and Space Administration, Washington, D. C.

METHODS AND RESULTS OF BOUNDARY LAYER MEASUREMENTS ON A GLIDER

Wilhelm Van Nes May 1978 12 p refs Transl. into ENGLISH

of the annual book "Bericht ueber Messmethoden und Messergebenisse bei Flugmessungen in der Grenzschicht" West Germany, Der Wissenschaftlichen Gesellschaft fuer Luftfahrt E. V., 1961 p 255-259 Translation was announced as A63-21852 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Leichtbau and Flugtechnik GmbH, Duisburg, West Germany
(Contract NASw-2790)
(NASA-TM-75294) Avail: NTIS HC A02/MF A01 CSCL 01A

Boundary layer measurements were carried out on a glider under natural conditions. Two effects are investigated: the effect of inconstancy of the development of static pressure within the boundary layer and the effect of the negative pressure difference in a sublaminar boundary layer. The results obtained by means of an ion probe in parallel connection confirm those results obtained by means of a pressure probe. Additional effects which have occurred during these measurements are briefly dealt with. Author

N78-24086# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
THE CROSSED-BEAM CORRELATION METHOD
G. T. Kalghatgi Nov. 1977 34 p refs
(AASU-339) Avail: NTIS HC A03/MF A01

The crossed beam correlation method, an optical technique which is used to measure localized turbulence properties without introducing any instrumentation in the flow field, is described. Features of the method include: (1) it is employed in a Schlieren mode to measure localized refractive index fluctuations from which localized mass density fluctuations can be referred; (2) in its attenuation mode it is used to monitor localized fluctuations in the light intensity caused by turbulence; then localized flow property fluctuations can be inferred if these can be related to light intensity fluctuations; and (3) kinematic properties of turbulence like convection speeds, eddy life times, integral length scales, relative intensity profiles, and relative power spectra are easily obtained. Author

N78-24087# Naval Ocean Systems Center, San Diego, Calif.
TURBULENT BOUNDARY LAYER WALL-PRESSURE FLUCTUATIONS ON AN AXISYMMETRIC BODY Technical Report, Jun. - Sep. 1968
H. V. L. Patrick 7 Sep. 1977 36 p refs
(AD-A051339; NOSC/TR-149) Avail: NTIS HC A03/MF A01 CSCL 20/4

A buoyancy propelled, fin-stabilized vehicle with a favorable pressure gradient over a major portion of its length was tested at Lake Pend Oreille, Idaho. Turbulent boundary layer wall-pressure fluctuations were measured at numerous locations of the body. In the region of favorable pressure gradient, the normalized wall-pressure spectral density was found to be similar to that on a flat plate. Transition from laminar to turbulent boundary layer flow occurred on the 30 inch maximum diameter vehicle at transition-length Reynolds numbers as large as 9.2 million. Author (GRA)

N78-24088# ARO, Inc., Arnold Air Force Station, Tenn.
SUPPORT INTERFERENCE ON AN OGIVE-CYLINDER MODEL AT HIGH ANGLE OF ATTACK IN TRANSONIC FLOW Final Report, 1 Jul. 1976 - 30 Sep. 1977
M. C. Altstatt and W. E. Dietz AEDC Mar. 1978 66 p refs Sponsored by the AF
(AD-A051689; AEDC-TR-78-8) Avail: NTIS HC A04/MF A01 CSCL 20/4

A combined experimental and analytical study was conducted to determine the relative magnitude of the support and tunnel wall interferences on an ogive-cylinder model at a high angle of attack in transonic flow. The tests were conducted in the AEDC Aerodynamic Wind Tunnel (4T). The results indicate that the strut support causes large reductions in the normal force on the model, while the effect attributable to the sting support is much smaller. A correction procedure applied to the data to remove support interference gives consistent results. The test data, combined with an inviscid analytic study, indicate that the wall interference effects were negligible. Solutions obtained using two computational methods compare well with experimental results. Author (GRA)

N78-24089# ARO, Inc., Arnold Air Force Station, Tenn.
SIMPLIFIED INPUT FOR CERTAIN AERODYNAMIC NOSE CONFIGURATIONS TO THE GRUMMAN QUICK-GEOMETRY SYSTEM. A KWIKNOSE USER'S MANUAL Final Report, Jan. - Sep. 1977
Frederick Schope AEDC Feb. 1978 96 p refs
(ARO Proj. V33A-A8A)
(AD-A051425; AEDC-TR-77-89) Avail: NTIS HC A05/MF A01 CSCL 20/4

This report is a user's manual for a FORTRAN computer program KWIKNOSE which, for certain axisymmetric and nonaxisymmetric nose configurations, provides simplified geometric input to the Grumman QUICK-geometry system, which in turn provides geometric information to various numerical flow codes. For a wide variety in choice of input parameters, KWIKNOSE sets up the QUICK input for an arbitrary sequence of conical and ogival sections. In this process, KWIKNOSE performs the tedious computations necessary to locate the intersection points of successive arcs and to insert optional fillets or rounds over nontangent intersections. In addition, the code is capable of inserting arbitrary multiple slicing planes into the top, bottom, and side of the vehicle. Slicing plane intersections may be filleted or rounded. Thus, for a minimum of input and manual calculation by the user, KWIKNOSE is tailored to modeling the geometry of a sliced multiconic vehicle capped with an asymmetrically ablated nose. This manual provides check cases for the various geometry options, a description of input and output, and a listing of the source deck. Author (GRA)

N78-24090# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NONLINEAR THEORY OF A BEARING SURFACE OF ARBITRARY EXTENT
A. N. Panchenkov 12 Oct. 1977 17 p refs Transl. into ENGLISH from Gidrodinamika Bolshikh Skorostey (USSR), no. 3, 1967 p 21-30
(AD-A051385; FTD-ID(RS)T-1567-77) Avail: NTIS HC A02/MF A01 CSCL 01/3

Difficulties encountered in the nonlinear problem of a wing of small extent in liquid and gas are primarily related to the complexity of the phenomena arising in a fluid when the motion of a wing of small extent moves with a large angle of attack. The formation of strong turbulent eddies at the leading and lateral edges, the large stream angle of taper, and the formation of a turbulent region behind the wing all result in the hydromechanical characteristics of the wing being nonlinear with respect to the angle of attack, so that the nonlinearity with its attendant increase in the lift of the wing, is substantial even at small angles of attack. A mathematical analysis was conducted to obtain theoretical results from the nonlinear theory. Author

N78-24091# Naval Surface Weapons Center, White Oak, Md.
TEMPERATURE-STEP EFFECTS ON DIRECT MEASUREMENT OF SKIN-FRICTION DRAG Final Report, 1 Jul. 1976 - 30 Sep. 1977
Robert L. P. Voisinet 7 Jul. 1977 51 p refs
(WR02302003)
(AD-A051340; NSWC/WOL/TR-77-7) Avail: NTIS HC A04/MF A01 CSCL 20/4

Wall temperature discontinuities can occur in skin friction balance tests whenever a balance drag element is thermally insulated from the surrounding test surface. An experimental study was conducted to investigate the effects of such a temperature step on the local friction drag. A temperature step was produced by varying the temperature of the NSWC skin friction balance drag element above the temperature of the surrounding nozzle wall. Drag element temperatures ranged from 100 K to 240 K with the surrounding wall maintained at a temperature of 89 K. Nominal Mach numbers were 2.9 and 4.9 over a unit Reynolds number range of 2.6 to 20 million per meter. The results show that the value of the measured shear stress is higher than the cold wall value for a drag element which is at a higher temperature than the surrounding wall temperature and the change in shear stress is proportional to the difference between the drag element and the surrounding wall temperatures. The data has been correlated and corrections to previously published skin friction results are presented. GRA

N78-24092# Air Force Geophysics Lab., Hanscom AFB, Mass. Aerospace Instrumentation Div.

COMPUTER PROGRAMS FOR THREE-DIMENSIONAL CABLE PROBLEMS IN TETHERED-BALLOON APPLICATIONS

John B. Wright 15 Sep. 1977 190 p ref
(AF Proj. 6665)
(AD-A051417; AFGL-TR-77-0203; AFGL-IP-258) Avail: NTIS HC A09/MF A01 CSCL 09/2

Three computer/calculator programs were developed to solve tethered-balloon cable problems. The programs provide information on cable tension, geometry, and spacial positions from the balloon to the surface with a variable profile of wind speeds and azimuths. One program allows the holding of a constant cable length and the determination of a new balloon altitude and cable profile for any number of different wind fields. Both printed and plotted outputs are provided. Complete documentation including flowcharts is provided to permit the programs to be adapted to computers having different language than the Hewlett Packard 9810 used in their development. Author (GRA)

N78-24093# Tel-Aviv Univ. (Israel). Dept. of Mathematical Sciences.

THREE DIMENSIONAL SUPERSONIC FLOW PAST BLUNT BODIES: NUMERICAL METHODS AND COMPUTATIONS Interim Report, 30 Jun. 1976 - 29 Jun. 1977

Saul S. Abarbanel 1977 46 p refs
(Grant AF-AFOSR-3035-76)
(AD-A050335; AFOSR-78-0120TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

Methods for computing numerically the flow past blunted bodies of revolution travelling at supersonic speeds and at angles of attack are developed, using finite difference schemes. Results are shown for a given configuration at two supersonic Mach numbers for which circumferential pressure distribution is given as well as the lift slope coefficient. To achieve greater computational efficiency a different method was introduced - one based on mapping the body into a line (in the 2-D case) or a rectangle. This was tested so far on the axisymmetric case. Author (GRA)

N78-24094# Auburn Univ., Ala. Engineering Experiment Station.

AN AERODYNAMIC ANALYSIS OF DEFORMED WINGS IN SUBSONIC AND SUPERSONIC FLOW Final Report, Jan. - Dec. 1977

John E. Burkhalter and James W. Purvis Mar. 1978 76 p refs
(Grant DAAG29-77-G-0067)
(AD-A052449; ARO-14802.1-A-E) Avail: NTIS HC A05/MF A01 CSCL 20/4

The research effort for the past year involved the development of theoretical prediction methods for the aerodynamic loading on a wing with a full span elevon. The methods are based on lifting surface Kernel function formulations in both subsonic and supersonic potential flow. The unique idea in both cases is the closed form-finite summation manner in which the Kernel function integral is solved. This method of solution avoides Mangler- and Cauchy-type singularity problems, encountered in classical numerical integration approaches, and leads to stable, rapidly convergent solutions. In subsonic flow, an existing Kernel function method for planar wings was modified by adding and assumed pressure loading function to account for the presence of the elevon. The assumed pressure loading distribution led to exact closed form solutions for section and total coefficients on the wing; however, for the case of the deflected elevon, some numerical integration procedures were required. Results of these computations agree very well with experimental data. In the supersonic Mach number regime, a lifting Kernel function method similar to the subsonic approach was developed for the planar wing case, but with appropriate Mach cone regions of integration taken into account. Various assumed pressure loading functions, all weighted by exact theoretical results, were required for different wing shapes. Numerical results produced stable (nonoscillatory) solutions which agreed well with experimental data, even for very low aspect ratio triangular wings.
Author (GRA)

N78-24095# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Labs.

EXPERIMENTAL MEASUREMENTS IN THE TURBULENT BOUNDARY LAYER OF A YAWED, SPINNING OGIVE-CYLINDER BODY OF REVOLUTION AT MACH 3.0. PART 1: DESCRIPTION OF THE EXPERIMENT AND DATA ANALYSIS Final Report

Lyle D. Kayser and Walter B. Sturek Jan. 1978 31 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A052301; ARBRL-MR-02808-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 20/4

Experimental results of surveys of the turbulent boundary layer on a secant-ogive-cylinder at angles of attack up to 6 degrees for spin rates of 0 and 333 rps at Mach = 3 are presented. Limited comparisons of the data to finite-difference three-dimensional boundary layer computations indicate encouraging agreement. The theory is shown to accurately model the effects of surface spin and the main effects of surface spin are shown to occur near the lee side of the model. Complete data tabulations are provided to facilitate their use for comparison to theoretical computations. Author

N78-24096# Texas A&M Univ., College Station.

THE DEVELOPMENT AND APPLICATION OF A SIMPLE METHOD FOR DETERMINING UNSTEADY AIRLOADS IN SUBSONIC COMPRESSIBLE FLOW Final Technical Report, 1 Jun. 1974 - 31 Dec. 1977

Balusu M. Rao, Vijayvardhan Elchuri, Paul R. Schatzle, and Larry J. McQuien Feb. 1978 100 p refs
(Grants DAHC04-74-G-0184; DAAG29-76-G-0241)
(AD-A052417; ARO-11695.2-E) Avail: NTIS HC A05/MF A01 CSCL 20/4

A numerical lifting surface method based on velocity potential formulation is applied for predicting aerodynamic loads in steady and unsteady flows for fixed as well as rotary wings. The theory and the numerical procedures are validated by comparing with other analytical and experimental results. The techniques developed resulted in very efficient computational schemes. GRA

N78-24097# Tennessee Univ. Space Inst., Tullahoma. Gasdynamics Div.

GUIDE TO THE OPERATION OF THE MIRADCOM/UTSI COMPUTER PROGRAM FOR PLUME INDUCED SEPARATION AT TRANSONIC SPEEDS

D. J. Spring (Army Missile Res. and Develop. Command) and T. H. Moulden Dec. 1977 149 p refs
(Grant DAAG29-77-G-0108; DA Proj. 1W3-62303-A-214)
(AD-A052619; DRDMI-T-78-28) Avail: NTIS HC A07/MF A01 CSCL 20/4

A small perturbation transonic analysis method which includes effects due to flow separation caused by an underexpanded propulsive jet has been developed and programmed for the US Army Missile Research and Development Command 6600 computer. This report describes the program and is intended to be a user's manual for the program. A complete listing of the program along with a sample input and output are included.
Author (GRA)

N78-24098# Boeing Commercial Airplane Co., Seattle, Wash.

APPLICATION OF LAMINAR FLOW CONTROL TO LARGE SUBSONIC MILITARY TRANSPORT AIRPLANES Final Technical Report, Mar. 1976 - Feb. 1977

Robert M. Kulfan and John D. Vachal Jul. 1977 150 p refs
(Contract F33615-76-C-3035; AF Proj. 1476)
(AD-A052422; D6-45148; AFFDL-TR-77-65) Avail: NTIS HC A07/MF A01 CSCL 01/3

A preliminary design study has been made to investigate the impact of the application of laminar flow control on the performance, weight, fuel consumption, and economics of a large transport airplane designed to carry a heavy payload (350,000 lb) for a long range (10,000 nmi). The study was conducted in three phases. In the first phase, conceptual design investigations were conducted to identify the features of an LFC airplane optimized to accomplish the mission objectives. A reference turbulent airplane also was developed in this phase. Design and analysis studies were made to develop the final LFC configuration. This configuration was sized to determine the

gross weight, engine size, wing area, and fuel requirements necessary to achieve the design mission. Various performance trade and sensitivity studies were conducted for the turbulent and LFC airplanes in the third phase. Life-cycle and operating cost evaluations were also made. A valid assessment of an LFC airplane must be preceded by an extensive design, development, and flight test program. Consequently, this study focused on identifying the relative benefits from applying LFC, and on the sensitivities of these relative benefits to the current major LFC uncertainty items. GRA

N78-24099# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.
EXPERIMENTAL INVESTIGATION OF AERODYNAMIC CHARACTERISTICS OF A TRACKED RAM AIR CUSHION VEHICLE Interim Report, Sep. 1973 - Dec. 1976
H. C. Curtiss, Jr. and W. F. Putnam Jan. 1978 112 p refs (Contract DOT-TSC-682)
(PB-277674; DOT-TSC-OST-77-35; AMS-TR-1318; DOT-TSC-OST-78-1) Avail: NTIS HC A06/MF A01 CSCL 01A

The results of an experimental and theoretical investigation of the longitudinal aerodynamic characteristics of a tracked ram air cushion vehicle are presented. Experiments were conducted both in a wind tunnel with a model and section of guideway and with the same model propelled along a 300 foot guideway. Experimental results are presented for the dependence of the lift, drag, and pitching moment of the model on model height above the guideway and winglet gap, providing basic data necessary for the analysis of longitudinal stability and ride qualities of the concept. The stability derivatives determined from the moving model experiments agreed well with the wind tunnel results. A theory is presented which shows good agreement with the experimental results for the stability derivatives. Author

N78-24100# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NONLINEAR CONICAL FLOWS OF GAS
B. N. Bulakh 27 Mar. 1978 576 p refs Transl. into ENGLISH of the book "Nelineynyye Konicheskiye Techeniya Gaza" Moscow, Nauka Press, 1970 p 1-343
(FTD-ID(RS)T-0266-78) Avail: NTIS HC A24/MF A01

During the axisymmetric flow of supersonic uniform flow about the round cone of gas the bow near the apex of the cone is also round, but flow behind shock waves are not uniform. Since the supersonic flow of gas the slight disturbances are not spread upstream, the flow of interest about the cone of finite length will be concealed as a semi-infinite cone. The parameters of flow prove to be constant along each ray/beam, which emerges from the apex/vertex of the streamlined cone. Such a field of flow is called conical and serves as the object/subject of this book. Author

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N78-24101# Civil Aeromedical Inst., Oklahoma City, Okla.
FLOTATION AND SURVIVAL EQUIPMENT STUDIES
E. B. McFadden, comp. Jan. 1978 74 p refs
(AD-A051869; FAA-AM-78-1) Avail: NTIS HC A03/MF A01 CSCL 06/7

A collection of various studies, conducted over 15 years, of flotation and survival equipment used or proposed for aviation application, including developmental and prototype designs is reported. Results of these studies were presented at scientific meetings and/or published in preprints or proceedings with limited distribution. Information obtained from several of the included studies is being used in the development of revised flotation equipment standards. Author

N78-24102# Civil Aeronautics Board, Washington, D.C.
AIRPORT ACTIVITY STATISTICS OF CERTIFICATED ROUTE AIR CARRIERS Semiannual Report
30 Jun. 1977 310 p Prepared jointly with Federal Aviation Administration, Washington D. C.
(AD-A052728) Avail: NTIS HC A14/MF A01 CSCL 01/5

This report furnishes airport activity of the Certificated Route Air Carriers. Included in the data are passenger enplanements, tons of enplaned freight, express, and mail. Both scheduled and non-scheduled service, and domestic and international operations are included. These data are shown by airport and carrier. Departures by airport, carrier and type of operation, and type of aircraft are also included. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N78-24103+ National Aviation Facilities Experimental Center, Atlantic City, N. J.
AIR TRAFFIC SEPARATION STUDIES: AN ANNOTATED LISTING OF READING MATERIALS Final Report, 1955 - 1976
Paul W. Bradbury Jan. 1978 116 p
(FAA Proj. 012-102-230)
(AD-A051130; FAA-EM-77-13; FAA-NA-77-15) Avail: NTIS HC A06 CSCL 01/2

This bibliographic compilation lists more than 325 reading materials concerned with separation standards for the air traffic control system. Related subjects, such as collision risk analysis, navigational track-keeping error, descriptions of proposed navigational systems or aids, and cost/benefit trade-off studies of ATC system design, are included to some extent, but selectively rather than extensively or in depth. Orientation of the materials selected for listing is largely, but not exclusively, toward oceanic enroute aspects of the international air traffic control systems. The North Atlantic system (NAT) is particularly evident. The style of presentation is tailored to facilitate rapid scan. Annotations are largely derivative from other sources, and the comments are descriptive rather than evaluatory. Comprehensiveness was sacrificed to selectivity to avoid unwieldness. Author

N78-24104# Electromagnetic Compatibility Analysis Center, Annapolis, Md.
MICROWAVE LANDING SYSTEM INTRA-AIRCRAFT EMC ANALYSIS Final Report
Philip E. Gawthrop (IIT Res. Inst., Annapolis, Md.) Mar. 1976 44 p refs
(Contracts DOT-FA70WAI-175; F19628-78-C-0006; AF Proj. 649E)
(AD-A052063; FAA-RD-77-109; ECAC-PR-76-006) Avail: NTIS HC A03/MF A01 CSCL 17/7

The electromagnetic compatibility of the Time Reference Scanning Beam Microwave Landing System (MLS) with other radiating systems on-board nine types of aircraft is discussed. The nine aircraft are the McDonnell Douglas DC-10, DC-9, DC-8, Boeing 747, 737, 727, 707, Lockheed Tristar L-1011, and the North American Rockwell T-39 Sabreliner. The MLS intra aircraft interference analysis was performed by calculating the interference power level at a receiving antenna, comparing the power with a user-specified interference threshold, and identifying the potential problems. Author

N78-24105# Lincoln Lab., Mass. Inst. of Tech., Lexington.
VERIFICATION OF DABS SENSOR SURVEILLANCE PERFORMANCE (ATCRBS MODE) AT TYPICAL ASR SITES THROUGHOUT CONUS
W. I. Wells 20 Dec. 1977 51 p refs
(Contract DOT-FA72WAI-261; F19628-78-C-0002; FAA Proj. 034-241-012)

(AD-A051128; FAA-RD-77-113) Avail: NTIS HC A04/MF A01 CSCL 17/7

A transportable measurement facility (TMF) incorporating antenna, r-f, and reply processing elements of a discrete address beacon system (DABS) sensor was sited at, and in the vicinity of, several FAA terminal ASR's throughout the United States. Data collected at these sites were thoroughly analyzed to verify the design of the DABS sensor and to establish the need for design refinements. Data pertaining to DABS and ATCRBS mode range and azimuth accuracy and to the total ATCRBS mode reply processing performance are presented. Both range and azimuth accuracies for the DABS sensor are shown to be a factor of four or five better than those provided by existing ARTS (BI-4) interrogators, and that the average blip/scan ratio is 98% or better, dropping only a few percentage points in crossing track situations. Author

N78-24106# Lincoln Lab., Mass. Inst. of Tech., Lexington.

SIMULATION OF SURVEILLANCE AND PROCESSING ALGORITHMS PROPOSED FOR THE DABS MODE OF BCAS

Patricia H. Mann 16 Feb. 1978 66 p ref

(Contracts DOT-FA77WAI-727; F19628-78-C-0002; FAA Proj. 052-241-04)

(AD-A052451; ATC-82; FAA-RD-77-138) Avail: NTIS HC A04/MF A01 CSCL 17/7

Surveillance Processing Algorithms for the DABS Mode of BCAS were implemented in software for the non-real time processing of air-to-air link data. The data to be processed may be either AMF recorded air-to-air data, or data derived from simulated flight encounters. Examples of simulation trials for a specific collision encounter are presented which illustrate the impact of increased ATCRBS fruit levels upon the performance of the surveillance processor. Detailed definitions of the surveillance processing algorithms are also provided. Author

N78-24107# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

BASES OF RADIO DIRECTION FINDING, PART 1

I. S. Kukes and M. Ye. Starik 22 Dec. 1977 523 p Transl. into ENGLISH of the book "Osnovy Radiopelengatsii" Moscow, Sovetskoye Radio press, 1964 p 1-516

(AD-A051951; FTD-ID(RS)T-2232-77-Pt-1) Avail: NTIS HC A22/MF A01 CSCL 17/3

Radio direction finders are widely used in air and marine transport for the solution of navigational problems (position finding of movable object, flight toward airport, ships in distress, and so forth); they are applied also for other target/purposes (research on the questions of radiowave propagation, observation of space vehicles and so forth). Known direction-finding methods are continuously being improved, increasingly more difficult methods are being developed and progress is made toward increasing the accuracy and sensitivity, as new direction-finding methods, improved theory, the frequency band and the field of application of direction finders are increased. All the enumerated questions are illuminated in periodic technical literature; however, until now, have not been systematized. In this book are presented the general theory of direction finding, procedures of calculation of direction finders and their cell/elements, and the errors of direction finding for their elimination. GRA

N78-24108# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

BASES OF RADIO DIRECTION FINDING, PART 2

I. S. Kukes and M. Ye. Starik 22 Dec. 1977 569 p refs Transl. into ENGLISH of the book "Osnovy Radiopelengatsii" Moscow, Sovetskoye Radio press, 1964 p 1-516

(AD-A051952; FTD-ID(RS)T-2232-77-Pt-2) Avail: NTIS HC A24/MF A01 CSCL 17/3

Contents: Problems of Radio Traffic; Principles and Methods of Radio Traffic; Antenna Systems of Radio Direction Finders; Instrument Errors; Effect of Locality and Environment; Errors of Radio Direction Finder, Connected with Radiowave Propagation; Calculation of Antenna Systems of Radio Direction Finders; Visual Radio Direction Finders; Tests of Radio Direction Finders; Different Applications of Radio Direction Finders; Accuracy of Position Finding by Radio Bearings; Laying of Radio Bearings on Map; Appendices, and References. GRA

N78-24109# Federal Aviation Administration, Washington, D. C. Office of Management Systems.

FAA AIR TRAFFIC ACTIVITY, FISCAL YEAR 1977

Patricia Wilson 30 Sep. 1977 233 p

(AD-A052403) Avail: NTIS HC A11/MF A01 CSCL 01/2

This report furnishes terminal and enroute air traffic activity information of the National Airspace System. The data have been reported by the FAA-operated Airport Traffic Control Towers (ATCTs), Air Route Traffic Control Centers (ARTCCs), Flight Service Stations (FSSs), Combined Station Towers (CS/Ts), International Flight Service Stations (IFSSs), and Approach Control Facilities. Author (GRA)

N78-24110# Department of Transportation, Washington, D. C. Office of Assistant Secretary for Systems Development and Technology.

DEPARTMENT OF TRANSPORTATION NATIONAL PLAN FOR NAVIGATION

Arthur Goldsmith, ed. Nov. 1977 110 p

(AD-A052269; DOT-TST-78-4) Avail: NTIS HC A06/MF A01 CSCL 17/7

The DOT National Plan for Navigation (NPN) is designed to provide a readily available document which addresses how the Department of Transportation (DOT) plans to meet its future needs and its obligation to the user. This is the third issue of the NPN. It is the official source of navigation system policy and plans for the DOT which is the major provider of civil used aids to navigation. In particular, it summarizes the plans for Government provided radio aids to navigation. While individual types of user equipment are not addressed, knowledge of system plans will enable equipment manufacturers to adjust their planning and scheduling. The NPN is the medium for addressing navigation problems. It describes the characteristics of navigation systems and then explains the various factors that must be considered in choosing a system and determining if one can be substituted for another. This document is intended to provide general information with references for the reader who wishes additional details. The background on navigation systems, currently available systems, and plans for future systems as well as phasing schedules are provided to enable the user to determine not only what is currently available, but to plan for probable obsolescence and the ability of new and improved systems. Author (GRA)

N78-24111# Rome Univ. (Italy). School of Aerospace Engineering.

USE OF SIMULATION TECHNIQUES IN THE PROBLEM OF AIR TRAFFIC CONTROL [L'USO DELLE TECNICHE DI SIMULAZIONE NEL PROBLEMA DEL CONTROLLO DEL TRAFFICO AEREO]

C. Bottiglieri and A. DiCola Oct. 1976 60 p refs In ITALIAN; ENGLISH summary Presented at the 24th Intern. Conf. on Commun., Geneva, 11-13 Oct. 1976

(Quad-Calc-Elett-21) Avail: NTIS HC A04/MF A01

The air-traffic control involves a series of necessarily interconnected problems, whose solution needs a charged system to work out the information and to plan the decisions with coordination. The use of simulation techniques with which the system is divided into simple parts and a sensibility of system is defined as regards some traffic configurations and flow of information. A scheme of the construction of the pertinent model and its testing with computer is suggested. This scheme also can be adopted for an ample class of other traffic system (motor, railway systems); it is reported on an application to a traffic system of simple structure. Author (ESA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N78-24112 Case Western Reserve Univ., Cleveland, Ohio.
AIRCRAFT SIZE AND AIR TRANSPORT COSTS Ph.D. Thesis
David John Nicol 1977 302 p
Avail: Univ. Microfilms Order No. 78-00554

A model of aircraft-related costs was developed which permits consideration of each major cost component in order to determine whether unit operating costs are lower for larger aircraft. Utilization of capacity is included as a decision variable and can assume values between zero and some maximum practical limit. Economies of scale with respect to aircraft size were found to exist for jet aircraft but they are not inevitable nor a persistent phenomenon. For smaller aircraft operating on long flights, the potential for cost decreases can be considerable. As larger aircraft are considered, however, this potential steadily diminishes in importance, to the extent that little potential for further reductions in unit cost appears to be available beyond the size corresponding to the largest aircraft in current commercial use.
Dissert. Abstr.

N78-24113# McDonnell-Douglas Corp., St. Louis, Mo.
AV-8B COMPOSITE WING GOVERNMENT/INDUSTRY BRIEFING
13 Apr. 1978 164 p Prepared in cooperation with Naval Air Systems Command, Washington, D. C.
Avail: NTIS HC A08/MF A01

Outlined in this document is the overall review of aircraft and wing configurations for various types of aircraft. The document presents the engineering design and specifications dealing with structure, composite materials, loads, wind pressure, wing skin, etc. The assemblage, quality control and fabrication of wing structures are reviewed.
G.Y.

N78-24114# Hindustan Aeronautics Ltd., Bangalore (India).
COMPARISON OF PREDICTED AND FLIGHT TEST TRAJECTORIES OF STORES JETTISONED FROM AIRCRAFT
S. M. Ramachandra 7 Sep. 1977 46 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Aircraft on Oct. 1978
Avail: NTIS HC A03/MF A01

A series of drop tank jettison trials were carried out over a wide speed range covering both gravity and power ejection. Later trials were also carried out on the release characteristics of stores with retarding systems. All these flight trials were recorded with motion picture photography from an accompanying chase aircraft. Trajectories predicted by using aerodynamic coefficients estimated from different methods are given. Observed trajectories in non-dimensional form are presented involving stores with and without fins together with corresponding analytical predictions for planar store motion for purposes of comparison. Comparisons are also provided for the linear and angular accelerations experienced by the stores along their trajectory. Whereas observations show good agreement to exist for the longitudinal component of the store trajectory, the vertical downward motion appears to be over predicted for power ejection and under predicted for gravity drop by the theory. Theoretical estimates of the store pitch angle show an oscillatory motion whereas a steady monotonic time variation is shown by the observed trajectories. Causes of trajectory discrepancies are also indicated.
Author

N78-24115*# National Aeronautics and Space Administration, Washington, D. C.
DATA ON CONDUCTING THE SAMEX-76 EXPERIMENT
Jun. 1978 175 p Transl. into ENGLISH from "Dannyye o Provedenii Eksperimenta SAMEKS-76" Acad of Sci. USSR, Moscow, 1978 p 1-106, 114-153 Transl. by Transemantics, Wash., D. C.
(Contract NASw-2792)
(NASA-TM-75107) Avail: NTIS HC A08/MF A01 CSCL 01C

The compilation of data on conducting the SAMEX-76 experiment is reported. This report includes many tables and graphs of the aircraft's flights and its measurements. Also given is the operation time of this equipment and the many observations that have been made by the Scientific Research Ship Akademik Korolev.
Author

N78-24116*# National Aeronautics and Space Administration, Washington, D. C.
DRAG REDUCTION FOR GLIDERS
F. X. Wortmann May 1978 16 p refs Transl. into ENGLISH from Aero-Revue Original language document announced as A66-15200 and A66-15198 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75293) Avail: NTIS HC A02/MF A01 CSCL 01C

The article discusses the causes of drag in gliders. The importance of maintaining laminar flow is emphasized. The problems of surface (or lack of) smoothness are outlined.
Author

N78-24117*# Systems Technology, Inc., Mountain View, Calif.
STUDY OF A SAFETY MARGIN SYSTEM FOR POWERED-LIFT STOL AIRCRAFT Final Report, Dec. 1976 - Jan. 1978
Robert K. Heffley and Wayne F. Jewell May 1978 160 p refs
(Contract NAS2-9418)
(NASA-CR-152139; STI-1095-1) Avail: NTIS HC A08/MF A01 CSCL 01C

A study was conducted to explore the feasibility of a safety margin system for powered-lift aircraft which require a backside piloting technique. The objective of the safety margin system was to present multiple safety margin criteria as a single variable which could be tracked manually or automatically and which could be monitored for the purpose of deriving safety margin status. The study involved a pilot-in-the-loop analysis of several safety margin system concepts and a simulation experiment to evaluate those concepts which showed promise of providing a good solution. A system was ultimately configured which offered reasonable compromises in controllability, status information content, and the ability to regulate the safety margin at some expense of the allowable low speed flight path envelope.
Author

N78-24118# Kaman Aerospace Corp., Bloomfield, Conn.
ADVANCED DEVELOPMENT OF A HELICOPTER ROTOR ISOLATION SYSTEM FOR IMPROVED RELIABILITY. VOLUME 1: SUMMARY REPORT Final Report, Jun. 1972 - Feb. 1976
Robert Jones and Joseph H. McGarvey Dec. 1977 70 p refs
(Contract DAAJ02-72-C-0082; DA Proj. 1F1-63204-DB-38)
(AD-A051318; R-1396-1-Vol-1; USAAMRDL-TR-77-23A) Avail: NTIS HC A04/MF A01 CSCL 01/3

This report includes the results of the analytical and experimental phases of a helicopter rotor isolation reliability and maintainability (R and M) program on a UH-1 helicopter, which was modified through the addition of a Dynamic Antiresonant Vibration Isolator (DAVI). The final flight test phase demonstrated that the DAVI-modified vehicle had substantially lower vibration levels than the standard vehicle. Vertically, the two-per-rev vibration level was reduced to less than one-fifth that of the standard vehicle through the transition speed range and less than one-half at high speeds. An R and M analysis indicated the Army could realize an annual cost savings of approximately $12,000,000 if 1000 Army UH-1Hs were equipped with DAVI isolation systems. This savings is predicated on the following assumptions: (1) vibration-induced failures will be reduced in proportion to the vibration reduction afforded by the DAVI isolation system, and (2) the UH-1Hs are utilized at the rate of 20 flight-hours per month.
GRA

N78-24119# Kaman Aerospace Corp., Bloomfield, Conn.
ADVANCED DEVELOPMENT OF A HELICOPTER ROTOR ISOLATION SYSTEM FOR IMPROVED RELIABILITY. VOLUME 2: DETAILED REPORT Final Report, Jun. 1972 - Feb. 1976
Robert Jones Dec. 1977 256 p refs
(Contract DAAJ02-72-C-0082; DA Proj. 1F1-63204-DB-38)
(AD-A051319; R-1396-2-Vol-2; USAAMRDL-TR-77-23B) Avail: NTIS HC A12/MF A01 CSCL 01/3

For abstract, see N78-24118.

N78-24120# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
EVALUATION OF A LIP-SEAL HYDRAULIC FITTING FOR THE F-14 AIRCRAFT Final Report

D. O. Bagwell 15 Dec. 1977 10 p
(AD-A051159; NADC-77292-60) Avail: NTIS HC A02/MF A01 CSCL 11/1

A new type of lip-seal fitting was evaluated for possible use on the F-14 aircraft. This fitting would be used interchangeably with the Resistoflex Dynatube which is now being exclusively used. Impulse, proof, burst, repeat assembly, and flexure testing was completed on representative samples. Three samples of sizes 6 mm, 9 mm, 13 mm and 25 mm were tested in accordance with MIL-F-18280 and Grumman Aerospace Company specification SP-G-017A. They successfully passed all tests. Compatibility with the Resistoflex Dynatube connector is established and it is recommended that this fitting be used interchangeably with the Dynatube fitting. Author (GRA)

N78-24121# Arinc Research Corp., Annapolis, Md.
RELIABILITY EVALUATION TEST PLANNING STUDY FOR BGM-34C REMOTELY PILOTED VEHICLE
R. R. Brooks Sep. 1977 78 p refs
(Contract F33657-77-D-0029)
(AD-A051332; Rept-1976-01-1-1640) Avail: NTIS HC A05/MF A01 CSCL 01/3

Results are presented of a study performed by ARINC Research Corporation for the Aeronautical Systems Division to provide the criteria from which the Government can plan for the most effective approach to a reliability test program for the BGM-34C remotely piloted vehicle. Three levels of test scope are defined for Government consideration. Author (GRA)

N78-24122# Boeing Vertol Co., Philadelphia, Pa.
HEAVY LIFT HELICOPTERS. ADVANCED TECHNOLOGY COMPONENT PROGRAM: HUB AND UPPER CONTROLS Final Report, Jul. 1971 - Jul. 1975
Sep. 1977 194 p refs
(Contract DAAJ01-71-C-0840)
(AD-A051348; USAAMRDL-TR-77-37) Avail: NTIS HC A09/MF A01 CSCL 01/3

The Heavy Lift Helicopter Advanced Technology Component (ATC) development program was conducted by the Boeing Vertol Company for the U.S. Army from July 1971 through July 1975. As a part of this program, an advanced rotor hub and upper controls system design was developed and demonstrated to be satisfactory for application to the XCH-62 Prototype HLH. The ATC hub and upper control component development/demonstration activities included the flap/lag pitch elastomeric bearing, frequency selective lag damper, and shear bearing development efforts; manufacturing techniques development; fretting inhibitor evaluation; safe-life, fail-safe, and endurance testing of major hub and upper control components; whirl tower tests; and integrated rotor-drive system tests. GRA

N78-24123# Naval Postgraduate School, Monterey, Calif.
DYNAMIC ANALYSIS OF A CAROUSEL REMOTELY PILOTED VEHICLE RECOVERY SYSTEM M.S. Thesis
Russell N. Robinson Dec. 1977 69 p refs
(AD-A052401) Avail: NTIS HC A04/MF A01 CSCL 01/5

A Carousel Remotely Piloted Vehicle (RPV) Recovery System consists of a vertical mast which supports a horizontal member that is free to rotate. The approaching RPV is caught by vertical cables suspended from the horizontal member and the kinetic energy of the RPV is dissipated through the motion of the recovery system. This thesis presents a simplified dynamic analysis to describe the motion of an RPV after impact with a recovery system simulating the carousel system. The equations of motion for the RPV were obtained from Lagrange's equations and modeled using the Continuous System Modeling Program on the IBM 360-67 computer. The results showed that damping was required on motion of both the horizontal member and the suspended cables in order to prevent possible damage to the 150 pound RPV at an assumed 50 knot approach speed. A sensitivity analysis was performed by varying the system design parameters and the results are presented in the body of the thesis. GRA

N78-24124# Lockheed-California Co., Burbank.
FORMULAS FOR TAKEOFF PERFORMANCE P3-A, B AND C AIRPLANES Final Report
Joseph G. Carrillo and William M. Purdy 1 Feb. 1978 26 p refs
(Contract N00014-77-C-0461)
(AD-A052354; LR-28461) Avail: NTIS HC A03/MF A01 CSCL 01/2

The increase in program steps to more than 200 and larger memory storage of handheld computers appears to make practical their use in preflight planning of military missions by flight crews. Such application would provide greater accuracy and enhance efficient utilization of airplane capability. Contract No. N00014-77-C-0461 authorized development of formulas to calculate takeoff field length requirements and pertinent airspeeds and powerplant performance to test the feasibility of this application. This report contains formulas for the performance items authorized by the contract. It is recommended that they be programmed for use with a handheld computer and that computer solutions be evaluated for flight planning for service missions of P-3 airplanes. Author (GRA)

N78-24125# Army Armament Research and Development Command, Watervliet, N. Y. Benet Weapons Lab.
VIBRATIONS OF A HELICOPTER ROTOR BLADE USING FINITE ELEMENT UNCONSTRAINED VARIATIONAL FORMULATIONS
J. J. Wu and C. N. Shen Sep. 1977 30 p refs
(DA Proj. 1L1-61102-AH-45)
(AD-A052670; AD-E400118; ARLCB-TR-77038) Avail: NTIS HC A03/MF A01 CSCL 01/3

In the past several years, a numerical method has been developed which is a generalized Rayleigh-Ritz finite element discretization using the combined concept of Lagrange multipliers and adjoint variables. This approach enables one to deal with problems associated with nonconservative forces, coupling effects and all types of boundary conditions in a routine fashion; and it appears promising in solving the vibration and dynamic stability problems associated with the complicated equations of a helicopter rotor blade. This paper presents the first application of the general method of the vibration problem of such a rotor blade. The numerical results from some demonstrative examples show that instability of flutter can occur in the range of operational rotor speed due to the coupled motion of flapping and root torsion without any aerodynamic force, if the torsional spring (or the pitch control link) is not sufficiently stiff. This instability does not appear to have been reported previously. GRA

N78-24126# Boeing Vertol Co., Philadelphia, Pa.
FINITE ELEMENT ANALYSIS FOR COMPLEX STRUCTURES, HELICOPTER TRANSMISSION HOUSING STRUCTURAL MODELING Final Report, Jul. 1975 - May 1977
R. W. Howells and J. J. Sciarra Jan. 1978 216 p refs
(Contract DAAJ02-75-C-0053; DA Proj. 1F2-62209-AH-76)
(AD-A052759; D210-11232-1; USAAMRDL-TR-77-32) Avail: NTIS HC A10/MF A01 CSCL 01/3

The objective of the Finite Element Analysis for Complex Structures program was to develop and demonstrate a comprehensive, finite element analytical technique with the capability and flexibility for analyzing helicopter transmission housings made of metal and/or composite materials. The work encompassed the study of thermal distortion and stress, and deflection due to static and dynamic loads, load path definition, dynamic response and the control of structural energy distribution. The results were used to optimize strength and weight, and to assess operational housing life, fail safety/safe life, and reliability. Some emphasis was placed on heat transfer analyses. Additional objectives were to integrate this housing analysis method with existing methods to form a comprehensive transmission analysis, and to validate these design tools so that they might be applied to future transmission configurations. A finite element model and analytical methods were applied to analyze a CH-47C helicopter's forward rotor transmission and also to define design modifications for structural optimization. GRA

N78-24127# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
ENERGY SAVINGS. AN AIRCRAFT CONSTRUCTOR'S VIEWPOINT [LES ECONOMIES D'ENERGIE. POINT DE VUE D'UN AVIONNEUR]
Philippe Amblard Paris Assoc. Aeron. et Astronautique de France 1977 17 p In FRENCH Presented at the 13th Intern.

Aeron. Congr., Paris, 2-3 Jun. 1977
(AAAF-NT-77-24; ISBN-2-7170-0449-1) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

The possibility of designing aircraft with reduced fuel consumption is examined. Present day techniques reviewed include engines with high dilution ratio, supercritical airfoils, mass reduction by using composite materials for secondary structures, and economic flight control. Future techniques include use of composite materials for main structural elements, and active control. Some projects discussed briefly are the Boeing 7X7, Lockheed L-1011-600A, Falcon 50, and Mercure 200. ESA

N78-24128# Association Aeronautique et Astronautique de France, Paris.
HELICOPTERS AND ENERGY SAVINGS [LES HELICOPTERES ET LES ECONOMIES D'ENERGIE]
Georges Petit 1977 35 p In FRENCH Presented at the 13th Intern. Aeron. Congr., Paris, 2-3 Jun. 1977
(AAAF-NT-77-25; ISBN-2-7170-0450-5) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

Possibilities of reducing the energy consumption of helicopters are discussed. The order of magnitude of the problem, i.e., the part helicopters play in total energy consumption, was established. The share of fuel consumption in comparison with total operational costs is dealt with. The energy balance of the helicopters Gazelle, Dauphin, and Puma is presented. Proposals for energy reduction are made which might lead to a 30% reduction due to engine improvements and 15% reduction resulting from aerodynamic improvements. Finally, a comparison with competitive aircraft, i.e., vertical takeoff aircraft, is made. ESA

N78-24129# Air France, Paris.
AN OPERATOR'S VIEWPOINT: HOW TO REDUCE THE FUEL CONSUMPTION IN AERONAUTICAL MAINTENANCE [LE POINT DE VUE D'UN EXPLOITANT: COMMENT REDUIRE LA CONSOMMATION DE CARBURANT DANS L'ENTRETIEN AERONAUTIQUE]
P. Kleitz Assoc. Aeron. et Astronautique de France 1977 42 p In FRENCH Presented at the 13th Intern. Aeron. Congr., Paris, 2-3 Jun. 1977
(AAAF-NT-77-26; ISBN-2-7170-0451-3) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

Possibilities for airline companies to reduce aircraft fuel consumption are indicated. Changes that influence fuel consumption most (mass change, performance change, and deterioration of engine performance) are outlined. ESA

N78-24130# Societe Francaise d'Equipments pour la Navigation Aerienne, Velizy-Villacoublay (France).
EQUIPMENT PERMITTING FUEL SAVINGS DURING APPROACH [UN EQUIPEMENT PERMETTANT D'ECONOMISER LE CARBURANT EN APPROCHE]
J. Sicre Paris Assoc. Aeron. et Astronautique de France 1977 13 p In FRENCH Presented at the 13th Intern. Aeron. Congr., Paris, 2-3 Jun. 1977
(AAAF-NT-77-27; ISBN-2-7170-0452-1) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

Equipment complementary to the automatic landing system lever allowing automatic decelerated approach of airline airplanes is described schematically. The decelerated approach, in comparison with the normal approach, leads to less noise perceived from the ground, fuel savings, and reduction of flight time. ESA

N78-24131# Association Aeronautique et Astronautique de France, Paris.
SUPERSONIC TRANSPORTATION FACED WITH ENERGY SAVINGS [LE TRANSPORT SUPERSONIQUE FACE AUX ECONOMIES D'ENERGIE]
G. Cormery 1977 20 p In FRENCH Presented at the 13th Intern. Aeron. Congr., Paris, 2-3 Jun. 1977
(AAAF-NT-77-28; ISBN-2-7170-0453-X) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

Energy savings aspects for supersonic aircraft are dealt with. Topics include air transportation and energy; supersonic transportation and air transportation; short and medium term technological innovation; and long term technological innovation. ESA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N78-24132*# Research Triangle Inst., Research Triangle Park, N. C.
GENERAL AVIATION AVIONICS EQUIPMENT MAINTENANCE Final Report
C. D. Parker and J. B. Tommerdahl May 1978 71 p refs
(Contract NAS1-14939)
(NASA-CR-145342; RTI/1464/00-00F) Avail: NTIS HC A04/MF A01 CSCL 01D

Maintenance of general aviation avionics equipment was investigated with emphasis on single engine and light twin engine general aviation aircraft. Factors considered include the regulatory agencies, avionics manufacturers, avionics repair stations, the statistical character of the general aviation community, and owners and operators. The maintenance, environment, and performance, repair costs, and reliability of avionics were defined. It is concluded that a significant economic stratification is reflected in the maintenance problems encountered, that careful attention to installations and use practices can have a very positive impact on maintenance problems, and that new technologies and a general growth in general aviation will impact maintenance.
Author

N78-24133# Institute for Defense Analyses, Arlington, Va. Cost Analysis Group.
ON SETTING AVIONIC SUBSYSTEM UNIT PRODUCTION COST GOALS Final Report
David C. Weimer Oct. 1977 79 p refs
(Contract DAHC15-73-C-0200)
(AD-A051337; AD-E500020; IDA/HQ-77-19573; P-1280)
Avail: NTIS HC A05/MF A01 CSCL 14/1

Major avionics subsystems for candidate aircraft developed under the Design-to-Cost (DTC) acquisition concept were analyzed to gain additional insight into the critical production cost goal-setting process. The candidate aircraft sample consisted of the Air Force F-16 and A-10, the Navy F-18 and the Army Advanced Attack Helicopter. A total of 23 avionics subsystems assigned to the candidate aircraft were investigated. It was found that only six of the 23 subsystems met Department of Defense criteria for authentic DTC programs. The other subsystems were developed and acquired by airframe prime contractors on a competitive fixed-price basis with priced options for production. In these programs, competitive pricing replaced DTC goal-setting. Based upon limited research findings, it was concluded that subcontractor goal-setting was usually masked by competitive pricing practices; the resulting development programs did not have the schedule, cost, and design tradeoff flexibility to properly pursue the cost goal. It also was concluded that the goal establishment process, as observed for those 6 subsystems examined, was effective and did include appropriate important criteria for goal selection. GRA

N78-24134# Arinc Research Corp., Annapolis, Md.
AIR FORCE AVIONICS STANDARDIZATION: AN ASSESSMENT OF SYSTEM/SUBSYSTEM STANDARDIZATION OPPORTUNITIES Final Report
S. Baily, D. A. Martinec, A. Savisaar, and N. Sullivan Mar. 1978 68 p refs
(Contract F09603-76-A-3231)
(AD-A052235; Rept-1910-13-2-1722) Avail: NTIS HC A04/MF A01 CSCL 15/5

The following specific contractual tasks were defined for ARINC Research by Aeronautical Systems Division avionics planning directorate ASD/XRE: Task 1: Provide engineering support in preparation for future INS procurement activities --

Perform the analyses and trade-off studies to support the Air Force INS single agency in the preparation of the RFP and source selection tools for use on the initial standard INS procurement. This effort was limited to support during the RFP preparation phase only). Task 2: Provide engineering support in analyzing new opportunities for specification development -Investigate and analyze Air Force avionics requirements to determine the patterns, the extent of force applications, and the commonality of force needs. Organize data by class of equipment, quantities, timeframe, application, and other pertinent market survey parameters. Develop criteria for weighing standardization opportunities and ranking opportunities as they are identified. Task 3: Provide engineering support to develop, refine, and update Avionics Planning Baseline Document -- Perform the analyses and data collection necessary to develop, refine, and update the Avionics Planning Baseline document.
GRA

N78-24135# Naval Postgraduate School, Monterey, Calif.
DESIGN AND CONSTRUCTION OF A FLIGHT MONITOR AND DATA RECORDER M.S. Thesis
Dennis Leland Kane Dec. 1977 96 p refs
(AD-A052405) Avail: NTIS HC A05/MF A01 CSCL 14/3

The design and preliminary testing of a microcomputer based flight monitor and data recorder, utilizing magnetic bubble memory, is reported. Component selection, software design and magnetic bubble storage system construction and testing are discussed. Difficulties encountered, both in software and bubble testing are reviewed, with results and remaining work summarized. Magnetic bubble memory technology is reviewed and its potential as a reliable, dense, low cost, non-volatile recording medium is noted. It is proposed that the microprocessor be utilized as a flight monitoring as well as a recording device to detect and report imminent extremis situations.
GRA

N78-24136# Yuma Proving Ground, Ariz.
INSTRUMENTATION DEVELOPMENT OF AN AIRBORNE RECORDING SYSTEM Final Report, Nov. 1976 - Dec. 1977
Martin Cretin Jan. 1978 54 p
(AD-A052348; YPG-336) Avail: NTIS HC A04/MF A01 CSCL 14/3

A methodology investigation of an airborne recording system was conducted at US Army Yuma Proving Ground (YPG), Arizona, from November 1976 through December 1977. This new system has been developed by the Air Delivery Engineering Branch at YPG for recording and processing accelerometer vibration spectral data in support of materiel air transportability and air delivery testing missions. The new data processing is based on a programmable calculator and suitable peripheral equipment. Accelerometer time histories from an analog recorder are digitized and processed on the programmable calculator system. Software provides for Fast Fourier computation of Power Spectal Density functions, acceleration and double amplitude displacement curves. The computed functions are displayed on an impact line printer for report mat printing. Hardware and software implementation of the new instrumentation system are described.
Author (GRA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N78-24137*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ON THE USE OF RELATIVE VELOCITY EXPONENTS FOR JET ENGINE EXHAUST NOISE
James R. Stone 1978 17 p refs Presented at 95th Meeting of Acoust. Soc. of Am., Providence, R. I., 16-19 May 1978
(NASA-TM-78873; E-9605) Avail: NTIS HC A02/MF A01 CSCL 20A

The effect of flight on jet engine exhaust noise has often been presented in terms of a relative velocity exponent, n, as a function of radiation angle. The value of n is given by the OASPL reduction due to relative velocity divided by 10 times the logarithm of the ratio of relative jet velocity to absolute jet velocity. In such terms, classical subsonic jet noise theory would result in a value of n being approximately 7 at 90 degree angle to the jet axis with n decreasing, but remaining positive, as the inlet axis is approached and increasing as the jet axis is approached. However, flight tests have shown a wide range of results, including negative values of n in some cases. In this paper it is shown that the exponent n is positive for pure subsonic jet mixing noise and varies, in a systematic manner, as a function of flight conditions and jet velocity.
Author

N78-24138*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN AND PRELIMINARY RESULTS OF A SEMITRANSPIRATION COOLED (LAMILLOY) LINER FOR A HIGH-PRESSURE HIGH-TEMPERATURE COMBUSTOR
Jerrold D. Wear, Arthur M. Trout, John M. Smith, and Robert E. Jones 1978 13 p refs To be presented at the 14th Propulsion Conf., Las Vegas, Nev., 25-27 Jul. 1978; sponsored by AIAA and SAE
(NASA-TM-78874; E-9607) Avail: NTIS HC A02/MF A01 CSCL 21E

A Lamilloy combustor liner was designed, fabricated and tested in a combustor at pressures up to 8 atmospheres. The liner was fabricated of a three layer Lamilloy structure and designed to replace a conventional step louver liner. The liner is to be used in a combustor that provides hot gases to a turbine cooling test facility at pressures up to 40 atmospheres. The Lamilloy liner was tested extensively at lower pressures and demonstrated lower metal temperatures than the conventional liner, while at the same time requiring about 40 percent less cooling air flow. Tests conducted at combustor exit temperatures in excess of 2200 K have not indicated any cooling or durability problems with the Lamilloy linear.
Author

N78-24139*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GENERAL AVIATION INTERNAL-COMBUSTION ENGINE RESEARCH PROGRAMS AT NASA-LEWIS RESEARCH CENTER
Edward A. Willis 1978 23 p refs Proposed for presentation at 14th Propulsion Conf., Las Vegas, Nev., 25-27 Jul. 1978; cosponsored by AIAA and SAE
(NASA-TM-78891; E-9628) Avail: NTIS HC A02/MF A01 CSCL 21A

An update is presented of non-turbine general aviation engine programs. The program encompasses conventional, lightweight diesel and rotary engines. It's three major thrusts are: (1) reduced SFC's; (2) improved fuels tolerance; and (3) reduced emissions. Current and planned future programs in such areas as lean operation, improved fuel management, advanced cooling techniques and advanced engine concepts, are described. These are expected to lay the technology base, by the mid to latter 1980's, for engines whose life cycle fuel costs are 30 to 50% lower than today's conventional engines.
Author

N78-24140# Cambridge Univ. (England).
NON-AXISYMMETRIC FLOW THROUGH ANNULAR ACTUATOR-DISCS. PART 1: INLET DISTORTION PROBLEM. PART 2: THE VIEW FROM THE ROTOR
W. R. Hawthorne, J. E. McCune (MIT, Cambridge, Mass.), N. A. Mitchell, and C. S. Tan (MIT, Cambridge, Mass.) 1977 59 p refs Presented at the AsME Gas Turbine Conf., London, 9-13 Apr. 1978
(Grant AF-AFOSR-2784-75)
(CUED/A-Turbo/TR89) Avail: NTIS HC A04/MF A01

The passage of distorted flow through an annular axial compressor rotor or stator is analyzed in the actuator-disc limit. In such a description the flow is steady in absolute coordinates. The resulting analysis yields an overall description of the blade row performance in the presence of inlet flow defects. The present (actuator-disc) analysis is compared successfully with an earlier

three dimensional analysis as well as with recent experimental data. At least two important distinct types of vorticity are shown to arise, one being directly analogous to the trailing vorticity (shed circulation) of classical wing theory, and a second (being analogous to the vorticity occurring in secondary flow theory) which arises directly as a result of inlet distortion. The resulting varying flow angles produce spanwise variation in blade loading, and consequent trailing vorticity. The two types of vorticity are therefore interrelated. The static pressure field is also affected by this coupling. Author

N78-24141*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
DEVELOPMENT OF A PLASMA SPRAYED CERAMIC GAS PATH SEAL FOR HIGH PRESSURE TURBINE APPLICATION Final Report, 9 Jun. 1977 - 9 Jan. 1978
L. T. Shiembob May 1978 86 p
(Contract NAS3-20623)
(NASA-CR-135387; PWA-5569-12) Avail: NTIS HC A05/MF A01 CSCL 21E

Development of the plasma sprayed graded, layered ZRO2/CoCrAlY seal system for gas turbine engine blade tip seal applications up to 1589 K (2400 F) surface temperature was continued. The effect of changing ZRO2/CoCrAlY ratios in the intermediate layers on thermal stresses was evaluated analytically with the goal of identifying the materials combinations which would minimize thermal stresses in the seal system. Three methods of inducing compressive residual stresses in the sprayed seal materials to offset tensile thermal stresses were analyzed. The most promising method, thermal prestraining, was selected based upon potential, feasibility and complexity considerations. The plasma spray equipment was modified to heat, control and monitor the substrate temperature during spraying. Specimens were fabricated and experimentally evaluated to: (1) substantiate the capability of the thermal prestrain method to develop compressive residual stresses in the sprayed structure and (2) define the effect of spraying on a heated substate on abradability, erosion and thermal shock characteristics of the seal system. Thermal stress analysis, including residual stresses and material properties variations, was performed and correlated with thermal shock test results. Seal system performance was assessed and recommendations for further development were made. Author

N78-24142*# National Aeronautics and Space Administration, Washington, D. C.
FUNDAMENTAL ASPECTS OF THE AERODYNAMICS OF TURBOJET ENGINE COMBUSTORS
M. Barrere Apr. 1978 35 p refs Transl. into ENGLISH from Rev. Fr. Mecan. (France), 3d and 4th Quarters 1975 p 55-68 Translation was announced as A76-39181 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by ONERA, Paris
(Contract NASw-2790)
(NASA-TM-75287; ONERA-TP-1976) Avail: NTIS HC A03/MF A01 CSCL 21E

Aerodynamic considerations in the design of high performance combustors for turbojet engines are discussed. Aerodynamic problems concerning the preparation of the fuel-air mixture, the recirculation zone where primary combustion occurs, the secondary combustion zone, and the dilution zone were examined. An aerodynamic analysis of the entire primary chamber ensemble was carried out to determine the pressure drop between entry and exit. The aerodynamics of afterburn chambers are discussed. A model which can be used to investigate the evolution of temperature, pressure, and rate and efficiency of combustion the length of the chamber was developed. Author

N78-24143# Naval Research Lab., Washington, D. C.
NUMERICAL PARAMETRIC STRESS ANALYSIS OF THE TF-30 TURBINE ENGINE THIRD-STAGE FAN-BLADE/DISK DOVETAIL REGION Final Report
L. A. Beaubien Jan. 1978 36 p refs
(AD-A051299; AD-E000121; NRL-MR-3671) Avail: NTIS HC A03/MF A01 CSCL 21/5

A two-dimensional finite element parametric analysis was conducted for the disk/blade dovetail region of the TF-30 turbine engine, assuming purely radial (centrifugal) loading of the blade. A graphical boundary matching procedure was used to determine a likely disk/blade interface force distribution. This distribution produced a stress concentration factor (SCF) of 5.3 in the disk fillet, relative to the average stress in the neck section of the disk. In addition, the SCF was found to decrease with decreasing interface friction. Parametric modification of the disk fillet resulted in a maximum SCF reduction of 27%, achieved with a fillet radius of three times the present one. For all studied combinations of interface force distribution, coefficient of friction and fillet geometry the point of maximum tensile stress occurred farther into the fillet (away from the contact region) than the point at which cracks appear to initiate (near, or just into the inboard edge of the contact area). However, different combinations of interface force and fillet geometry result in different degrees of spread of the tensile stress concentration from the fillet area into the contact area. Finally, the effects of some assumed interface force perturbations due to non-radial (non-centrifugal) loading are discussed. Author (GRA)

N78-24144# Systems Control, Inc., Palo Alto, Calif. Aeronautical and Marine Systems Div.
F100 MULTIVARIABLE CONTROL SYNTHESIS PROGRAM. VOLUME 1: DEVELOPMENT OF F100 CONTROL SYSTEM Final Report, 1 Aug. 1975 - 31 Dec. 1976
Ronald L. DeHoff, W. Earl Hall, Jr., Richard J. Adams, and Narendra K. Gupta Jun. 1977 328 p refs 2 Vol.
(Contract F33615-75-C-2053; AF Proj. 3066)
(AD-A052420; AFAPL-TR-77-35-Vol-1) Avail: NTIS HC A15/MF A01 CSCL 21/5

The objective of the F100 multivariable controls program was to demonstrate modern control design methodology applied to a state-of-the-art aircraft turbine over its entire flight envelope. Linear quadratic regulator design methods were used to develop feedback gains for a series of operating points. Reference schedules were used to translate pilot and ambient inputs to reference point specifications. A transient controller produced smooth and rapid transitions from one operating point to another. A variable structure integral trim system produced specified steady-state performance and limit accommodation in the presence of simulated degradation effects and instrument errors. The resulting control logic was extensively tested on a hybrid simulation of the F100 turbofan and will be used to control an engine in an altitude test cell. The details of the design procedure, linear model analysis and a summary of digital and hybrid simulation tests results are presented in this report. Author (GRA)

N78-24145# Systems Control, Inc., Palo Alto, Calif. Aeronautical and Marine Systems Div.
F100 MULTIVARIABLE CONTROL SYNTHESIS PROGRAM. VOLUME 2: APPENDICES A THROUGH K Final Report, 1 Aug. 1975 - 31 Dec. 1976
Ronald L. DeHoff, W. Earl Hall, Jr., Richard J. Adams, and Narendra K. Gupta Jun. 1977 507 p refs
(Contract F33615-75-C-2053; AF Proj. 3066)
(AD-A052346; AFAPL-TR-77-35-Vol-2) Avail: NTIS HC A22/MF A01 CSCL 21/5
For Abstract, see N78-24144.

N78-24146# Aeronautical Research Labs., Melbourne (Australia).
VIBRATION INVESTIGATION OF HELICOPTER ENGINE COOLING FAN
N. S. Swansson and G. A. Duke Mar. 1977 22 p refs
(AD-A047081; ARL/ME-363) Avail: NTIS HC A02/MF A01 CSCL 21E

An investigation into the cause of the unacceptably high incidence of fatigue failure of blades in the engine cooling fan fitted to Sioux helicopters led to a search for resonant frequencies of the fan blades. Tests on a stationary fan and in a rotating rig showed resonant vibration at various fan speeds; in particular, high stresses were generated by a second shaft order resonance close to the normal operating speed. A modification to overcome the problem was proposed, consisting of a stainless steel shroud fitted over the blade tips. Tests showed that this modification reduced stresses to a negligible level, and the mechanical soundness of the scheme was confirmed by an endurance run followed by an overspeed test. The modified fan was fitted to a helicopter and measurements comparing its cooling performance with a standard fan showed only small differences. Author (GRA)

N78-24147# Solar Turbines International, San Diego, Calif.
ISOTHERMAL ROLL FORGING OF T55 COMPRESSOR BLADES Interim Report, 10 May 1976 - 10 Sep. 1977
Fred K. Rose and Arthur G. Metcalfe Dec. 1977 104 p refs Prepared for Avco Lycoming Div., Stratford, Conn.
(Contract DAAG46-76-C-0043)
(AD-A052817; RDR-1841-14; USAAVRADCOM-77-11; AMMRC-CTR-77-32) Avail: NTIS HC A06/MF A01 CSCL 11/6

The objective of this manufacturing technology program was to demonstrate feasibility to produce T55 compressor blades by isothermal roll forging within 0.010 inch of drawing tolerances. This objective was accomplished through process definition and application to blades in Ti6Al4V for proofing and in AM-350 steel for the T55 engine. Satisfactory structure and mechanical properties were achieved in AM-350 steel after isothermal rolling. Cost analyses showed good potential for progressive cost reduction with continued work over present methods of production.
Author (GRA)

N78-24148# Army Armament Research and Development Command, Watervliet, N. Y. Benet Weapons Lab.
REINFORCED COBALT ALLOY COMPOSITE FOR TURBINE BLADE APPLICATION
I. Ahmad and J. M. Barranco Jul. 1977 20 p refs
(DA Proj. 1L1-62105-AH-84)
(AD-A052669; AD-E400096) Avail: NTIS HC A02/MF A01 CSCL 21/5

A composite of 0.42 V(f)W-2% ThO2 filament reinforced cobalt base alloy has been developed. It can be fabricated by conventional investment casting process, has a 1093 C (2000 F), 100 hr. stress-to-rupture of 206 MN/sq M (30Ksi), and a charpy impact strength of 280.0 in-lb at 835 C as compared with 20.6 in-lb for the unreinforced alloy. Also the feasibility of casting a prototype first stage blade of JT9D engine has been demonstrated.
Author (GRA)

N78-24149# Massachusetts Inst. of Tech., Cambridge. Gas Turbine Lab.
STUDIES ON TRANSONIC TURBINE WITH FILM-COOLED BLADES Annual Report, 1 Jul. 1976 - 30 Jun. 1977
N. Adams, F. Hajjar, R. F. Topping, and J. F. Louis Sep. 1977 123 p refs
(Contract N00014-76-C-0253)
(AD-A052423; Rept-77-1) Avail: NTIS HC A06/MF A01 CSCL 13/7

During the fourth year of the contract, further advances were made towards the goal of gathering the heat transfer and aerodynamics flow data necessary for a good understanding of the performance of film-cooled, highly-loaded, transonic turbine blading. Surface Mach number and heat transfer rate distributions were determined for a reference transonic airfoil over a range of exit Mach numbers, for inlet incidence angle variation of + or - 15 deg. An evaluation and comparison of all cascade data collected so far was then conducted. Progress was also made in the investigation of the effects of unsteadiness on transonic airfoil aerodynamics and heat transfer.
Author (GRA)

N78-24150# Texas A&M Univ., College Station. Dept. of Industrial Engineering.
REPLACEMENT PROCESS ANALYSIS: AN INTERIM REPORT ON REPLACEMENT MODELS Interim Report, 1 Oct. 1977 - 1 Feb. 1978
Po-Wen Hu and Laurence L. George 30 Jan. 1978 38 p refs
(Grant AF-AFOSR-3501-78)
(AD-A052411; AFOSR-78-0679TR) Avail: NTIS HC A03/MF A01 CSCL 21/5

This report describes models for the aircraft engine replacement processes and models for the probability distribution of engine ages at failure. Potential uses of these models for predicting replacement requirements are discussed. Also models for the randomness of flying hours on different aircraft are proposed for the study of the effect on replacement models which assume each aircraft flies an equal share of a flying hour program. The first section briefly describes the problem of computing replacement requirements for a fleet of aircraft. The second section describes several models of engine lives, ages at replacement, or times between replacement. These models are fundamental to the computation of replacement requirements because replacement requirements are computed based on engine life data. The third section describes models for a problem that is not usually recognized either theoretically or in practice; not all aircraft fly the same share of a flying hour program. The future work is to incorporate the models of engine lives in section 2 and the models for aircraft flying times in section 3 into a procedure for computing replacement requirements.
Author (GRA)

N78-24151# European Space Agency, Paris (France).
FUNDAMENTAL INVESTIGATIONS ON EFFUSION COOLING OF TURBINE BLADES
Heinz Kruse Apr. 1978 118 p refs Transl. into ENGLISH of 'Grundlegende Untersuch. zur Effusionskuehlung von Turbinenschaufeln', DFVLR, Cologne Report DLR-FB-77-39, 2 Sep. 1977 Original report in GERMAN previously announced as N78-18074 Original German report available from DFVLR, Cologne DM 45.80
(ESA-TT-469; DLR-FB-77-39) Avail: NTIS HC A06/MF A01

Developing effusion cooled turbine blades using porous materials will be difficult. A more promising technique is that of blowing through discrete holes distributed over the entire blade surface. The influence of blowing, on boundary layer development, with special regard to the arrangement of the holes, was experimentally investigated on a flat plate model, together with the attainable cooling effectiveness by measurements in hot gas experiments. The boundary layer phenomena at perforated walls with blowing are described by means of an empirical model for the turbulent shear stresses using a two-dimensional calculation method. Results are compared with boundary layer measurements.
Author (ESA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

No abstracts in this category.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N78-24152# National Aviation Facilities Experimental Center, Atlantic City, N. J.
DESIGN AND EVALUATION OF VISIBILITY SENSOR/RUNWAY VISUAL RANGE COMPUTER INTERFACE CIRCUITRY Final Report, Nov. 1974 - Sep. 1975
James E. Newcomb Jan. 1978 35 p
(FAA Proj. 151-461-090)
(AD-A051175; FAA-NA-76-19; FAA-RD-77-86) Avail: NTIS HC A03/MF A01 CSCL 01/2

Runway visual range (RVR) is an aviation visibility value obtained by utilizing a special purpose signal data converter. This report describes the design and testing of an interface circuit to permit use of the EG&G model 207 Forward Scatter Meter (FSM) with the RVR computer. The output of the FSM is an 0 - 5 V d.c. analog voltage proportional to the scattering coefficient. This circuit design changes the analog voltage to a pulse train with pulse rate, width, and amplitude comparable to the standard transmissometer output. Circuit design was validated by system tests. The new design produced computer-display RVR

values equivalent to those normally provided by an NBS transmissometer. It was concluded that the circuit design does provide accurate interface between the EG&G model 207 FSM and FA-7871-type signal data converters. Author

N78-24153# National Aviation Facilities Experimental Center, Atlantic City, N. J.
EVALUATION OF A 100-WATT ELEVATED HIGH-INTENSITY RUNWAY EDGE LIGHT Final Report, Jun. 1975 - Jul. 1977
Raymond E. Johnston and E. Leon Reamer Mar. 1978 19 p refs
(FAA Proj. 072-424-500)
(AD-A051651; FAA-NA-77-47; FAA-RD-77-176) Avail: NTIS HC A02/MF A01 CSCL 01/5

The purpose of this project is to evaluate a newly designed, evaluated, high intensity runway edge light using a 100 watt lamp as its light source, rather than the standard 200 watt lamp, to determine if the lower wattage lamp and fixture combination would be satisfactory for category 1 and category 2 low-visibility operations, where a Federal Aviation Administration Specification type L-862 runway edge light fixture would be required. Pilot opinion during flight tests indicates that an installed group A version of the experimental runway edge light unit is visually adequate for category 1 weather operations and should be adequate for category 2 operations. Group A lights, however, did not meet the Office of Airport Programs Specifications for L-862 runway edge lights. An improved group B version will meet both requirements, since it satisfactorily passed the L-862 photometric specifications. Author

N78-24154# National Aviation Facilities Experimental Center, Atlantic City, N. J.
FEASIBILITY STUDY FOR SIMULATION OF AN AIRPORT TOWER CONTROL ENVIRONMENT Final Report, May 1976 - Mar. 1977
Helen W. Hamilton Feb. 1978 84 p refs
(FAA Proj. 216-102-100)
(AD-A051174; FAA-NA-77-33; FAA-RD-77-190) Avail: NTIS HC A05/MF A01 CSCL 01/2

The feasibility and desirability of developing an airport tower control simulation training facility at the FAA Academy was investigated. Training program needs were assessed, and the state-of-the-art in simulation technology was surveyed. Several large-scale airport tower and ship's bridge simulators are described and evaluated from an operational and engineering viewpoint; also, a number of flight simulators and image generation and projection systems are considered with regard to the applicability of the concepts to the FAA training requirements. Computer-generated image systems versus other imaging technologies are discussed with reference to realism requirements, capability for efficient generation of instructional materials, and for objective student evaluation. The large number of visual-scene simulation facilities presently in use or under contract development for a wide variety of uses indicates that a tower control application is entirely feasible. Author

N78-24155# Department of Transportation, Washington, D. C. ATC Systems Div.
PROJECT PLAN: TOWER AUTOMATED GROUND SURVEILLANCE SYSTEM DEVELOPMENT PROGRAM Development Plan, FY 1978
M. E. Perie Jan. 1978 18 p refs
(AD-A051621; FAA-RD-78-4) Avail: NTIS HC A02/MF A01 CSCL 17/9

The tower automated ground surveillance system (TAGS) is designed to provide automation support for air traffic controllers in the tower cab, and increase surface traffic handling capacity, minimize delays, and provide all-weather control and guidance for the airport surface traffic control (ASTC) system. The TAGS system, having a clear, uncluttered presentation of each target and its identity, will eliminate voice channel saturation and permit ground control capacity in bad visibility to equal that in good visibility. TAGS will also become the baseline automation system to increase ASTC system capacity in the future air traffic control system. Author

N78-24156# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
COST-EFFECTIVENESS OF FLIGHT SIMULATORS FOR MILITARY TRAINING. VOLUME 1: USE AND EFFECTIVENESS OF FLIGHT SIMULATORS Final Report, Apr. 1976 - Jul. 1977
Jesse Orlansky and Joseph String Aug. 1977 167 p refs
(Contract DAHC15-73-C-0200)
(AD-A052801; AD-E500013; IDA/HQ-77-19470; P-1275-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 01/1

Flight simulators cost less to operate than do aircraft; estimates range from 5 to 20 percent. Many studies have shown that skills learned in flight simulators can be performed successfully in aircraft, i.e., the use of flight simulators for training purposes saves flight time. The critical issue is whether the amount of flight time saved by the use of simulators is worth their cost. The cost-effectiveness of flight simulators for training has been demonstrated only in a few recent studies which report that the procurement cost of simulators can be amortized in a few years. Current R and D about flight simulators centers about the need for motion and wide angle visual display systems. Flight simulators have achieved their greatest use by the military so far in undergraduate flight training. Their greatest potential for future savings lies in transition and continuation training which account for the major costs of military flying. Consistent methods of data collection and cost estimating, not now available, are needed to evaluate the cost-effectiveness of alternative flight training programs, including the use of various types of simulators, part-task trainers, new instructional strategies, and the like. The report provides a preliminary cost model which identifies the data needed to develop cost estimates for use in cost-effectiveness analyses of flight training. Author (GRA)

N78-24157# Air Force Human Resources Lab., Brooks AFB, Tex. Flying Training Div.
EVALUATION OF T-37 IFS SYLLABI IN THE ASPT Final Report, Mar. 1976 - Jul. 1977
Douglas C. Weyer and John H. Fuller Dec. 1977 33 p refs
(AD-A052624; AFHRL-TR-77-61) Avail: NTIS HC A03/MF A01 CSCL 05/9

Two syllabi were developed for potential use in the T-37 phase of undergraduate pilot training (UPT), when the Air Training Command's (ATC) Instrument Flight Simulator (IFS) became operational. These syllabi were designed to maximize the use of proven instructional strategies with state-of-the-art simulators; the goal was to demonstrate that such a program would permit using only one aircraft check ride for validation of instrument skill learning. Four UPT students from Class 77-03 were trained using the first syllabus; and four students from Class 77-05 were trained using the second syllabus. The remaining students in each of the respective classes, trained using the current ATC syllabus, were used as control groups. The Advanced Simulator for Pilot Training (ASPT), modified to simulate IFS capabilities as closely as possible, was used as the test vehicle. Comparisons were made between average training times required by the experimental groups (progressed on a proficiency basis) and average training times required by the remainder of the UPT classes, using the conventional syllabus. Average check ride scores were compared for all groups. Training effectiveness ratios were computed by training category for each of the two syllabi tested. Using these syllabi, which maximized the use of available devices (T-4 trainers and the ASPT as modified to approximate the IFS), it was demonstrated that most of the instrument training currently accomplished using T-37 aircraft can be accomplished in the IFS with no degradation in pilot output quality; an average of 2.4 aircraft hours was required for experimental subjects, as compared with 15.8 aircraft hours currently used. GRA

N78-24158# AiResearch Mfg. Co., Phoenix, Ariz.
ADVANCED TECHNOLOGY SERVICING EQUIPMENT FOR ARMY AIRCRAFT Final Report
R. R. Mejdrich Dec. 1977 192 p
(Contract DAAJ02-76-C-0042; DA Proj. 1F2-62209-AH-76)
(AD-A052652; AiResearch-31-2491B; USAAMRDL-TR-77-33) Avail: NTIS HC A09/MF A01 CSCL 01/5

The purpose of this effort was to define an advanced Ground Power Unit (GPU) to service AAH and UTTAS helicopters. The GPU was to be lightweight, air-transportable, highly mobile, and

use aircraft equipment wherever possible. The program included the following activities: Aircraft requirements verification; trade-off analyses to select specific components; design and component compatability verification; and preparation of specification and layout drawings defining conceptual design. Author (GRA)

N78-24159# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla. Detachment 1 ADTC
NONDESTRUCTIVE PAVEMENT EVALUATION Final Report, 1 Oct. 1976 - 30 Sep. 1977
B. M. Das Oct. 1977 23 p refs
(AD-A052707; CEEDO-TR-77-41) Avail: NTIS HC A02/MF A01 CSCL 01/5

Research has been in progress for about 10 years to develop a compatible pavement evaluation procedure for airfields based on nondestructive tests. A successful nondestructive pavement evaluation technique will reduce the time of closure of various airfield facilities needed to conduct destructive tests required for conventional pavement evaluation. This study provides a comparison of the projected pavement life of several airfield features estimated by nondestructive and destructive pavement evaluation procedures. For aircraft and gross loads on similar pavement sections, the nondestructive evaluation procedure yields higher numbers of allowable operations as compared to that obtained by the destructive test evaluation technique at this point in the research effort. Follow-on research is planned which will cause the two evaluation procedures to yield more closely compatible numbers. Author (GRA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N78-24160*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PAYLOAD OPERATIONS CONTROL CENTER NETWORK (POCCNET) SYSTEMS DEFINITION PHASE STUDY REPORT
Richard DesJardins Jan. 1978 287 p Submitted for publication Prepared in cooperation with Computer Sci. Corp., Los Angeles, Calif., Westinghouse Elec. Corp., Pittsburgh, Pa. and OAO Corp., Beltsville, Md.
(NASA-TM-79567; MOD-6SR/0178) Avail: NTIS HC A13/MF A01 CSCL 22A

The results of the studies performed during the systems definition phase of POCCNET are presented. The concept of POCCNET as a system of standard POCCs is described and an analysis of system requirements is also included. Alternative systems concepts were evaluated as well as various methods for development of reliable reusable software. A number of POCC application areas, such as command management, on board computer support, and simulation were also studied. Other areas of investigation included the operation of POCCNET systems, the facility requirements and usage. Author

N78-24161*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, Sep. - Oct. 1977
15 Dec. 1977 230 p refs
(Contract NAS7-100)
(NASA-CR-157109; JPL-PR-42-42) Avail: NTIS HC A11/MF A01 CSCL 22A

Presented is Deep Space Network (DSN) progress in flight project support, tracking and data acquisition (TDA) research and technology, network engineering, hardware and software implementation, and operations. For individual titles, see N78-24162 through N78-24186.

N78-24162*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Deep Space Network 15 Dec. 1977 p 1-3 (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

The objectives, functions, and organization of the Deep Space Network are summarized; deep space station, ground communication, and network operations control capabilities are described. Author

N78-24163*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TELEMETRY SYSTEM, MARK 3-77 c17
E. C. Gatz *In its* The Deep Space Network 15 Dec. 1977 p 4-12 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

A description is given of the DSN Telemetry System, Mark 3-77, which is used to support multiple deep space missions. Telemetry functions performed by the Deep Space Stations, Ground Communications Facility, and the Network Operations Control Center are defined. Recent improvements to the system and planned upgrades are described. Author

N78-24164*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VOYAGER FLIGHT PROJECT: DSN TELECOMMUNICATIONS COMPATIBILITY TEST PROGRAM c32
A. I. Bryan, R. P. Kemp, and B. D. Madsen *In its* The Deep Space Network 15 Dec. 1977 p 13-27 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

The Voyager Flight Project - DSN Telecommunications Compatibility Test Program consisted of three phases: Subsystem Design, System Design, and System Verification Tests. Subsystem Design Tests were performed during mid 1976. System Design Tests were performed during late 1976 and early 1977. System Verification Tests were performed during the spring and summer of 1977. This article describes the System Design Tests and test results that provided the basis for establishment of telecommunications design between the DSN and the Voyager Flight Project. Author

N78-24165*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING EXTENDED MISSION SUPPORT c32
T. W. Howe *In its* The Deep Space Network 15 Dec. 1977 p 28-33 (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

The period from 1 July through 31 August 1977 is covered and included is the remainder of post DSN Mark 3 Data Subsystem Implementation Project Viking-related testing at DSS 14. Also included are reports on the Viking DSN Discrepancy Reporting System, Viking command support, tracking support, and periodic tests conducted with the Viking spacecraft. Author

N78-24166*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT c14
P. S. Goodwin and G. M. Rockwell *In its* The Deep Space Network 15 Dec. 1977 p 34-41 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

Activities of the Network Operations organization in support of the Helios Project from 15 August 1977 through 15 October 1977 are reported. Included in this article is information on the Mark 3 Data Subsystem update at the conjoint Deep Space Station 42/43 complex (Canberra, Australia), an update on Radio Science Activities, and other mission-oriented activities. Author

N78-24167*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A FIRST-PRINCIPLES DERIVATION OF DOPPLER NOISE EXPECTED FROM SOLAR WIND DENSITY FLUCTUATIONS c92
P. S. Callahan *In its* The Deep Space Network 15 Dec. 1977 p 42-53 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 03B

The level of Doppler noise (DN) expected from solar wind (SW) density fluctuations (DF) is derived beginning with the expression for refractive index variations. The calculation takes account of up and downlink paths and of the method actually used to produce the DN values. The usual assumptions that the DF are frozen in, that the large-scale radial variation can be separated from the DF, that the DF power spectrum is a power law with outer scale k sub 0 and that the DF are homogeneous on scales less than 2c delta t, delta t = sample time, are made. The result agrees quite well with previous observations of DN. Corrections for the finite number of points used in the actual algorithm are discussed. Author

N78-24168*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VLBI (VERY LONG BASELINE INTERFEROMETRY) INSTRUMENTAL EFFECTS, PART 1 **c32**
J. W. Layland and W. J. Hurd *In its* The Deep Space Network 15 Dec. 1977 p 54-80 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

Very Long Baseline Interferometry (VLBI) is a method for observation of extragalactic radio sources which appears to have potential for precise long-distance earth surveying, clock synchronization and spacecraft navigation. Many researchers have been working to establish the accuracy of VLBI observations. The intent of the work reported here is to review the principal components of the VLBI instrument in order to estimate and/or bound the systematic error contributions. In this first of a series of articles, the definitions and tools which are needed in order to apply filter transfer-function analysis to the VLBI receiver are established and they are used to estimate the sensitivity of the VLBI receiver to plausible filter variations. Author

N78-24169*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VLBI CLOCK SYNC AND THE EARTH'S ROTATIONAL INSTABILITY **c35**
A. W. Layland and A. N. Mathews *In its* The Deep Space Network 15 Dec. 1977 p 81-84 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

Preparation is being made by the DSN to monitor the stability of its clocks and frequency standards in the 64 meter net by means of VLBI. Since variations in the earth's rotation rate represent an error source to VLBI clock synchronization, the Allan Variance of the earth rotation was calculated to find that, in a long-term sense at least, these variations do not noticeably increase the differential instability of two clocks as measured by Intercontinental VLBI. Author

N78-24170*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
X- AND K-BAND MASER DEVELOPMENT: EFFECTS OF INTERFERING SIGNALS **c36**
R. C. Clauss *In its* The Deep Space Network 15 Dec. 1977 p 85-87 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 20E

Signals at levels exceeding - 90 dbmW at the input connection of a traveling-wave maser can affect maser performance in a variety of ways. Both S band and X band masers are considered where interfering signals are: (1) within the maser bandpass, (2) near the maser bandpass, and (3) far from the maser bandpass, where mixing with the maser pump can occur. Author

N78-24171*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPLEX MIXER SYSTEM MODIFICATIONS **c32**
G. L. Stevens *In its* The Deep Space Network 15 Dec. 1977 p 88-91 ref (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

Modifications of the complex mixer system to increase bandwidth and number of channels were made. Three modified complex mixers were installed at DSS 14 and were used to process planetary radar signals in March and April of 1977. Author

N78-24172*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MINIMUM-WEIGHT CODEWORDS IN THE (128,64) BCH **c32**
L. D. Baumert and L. R. Welch (Univ. of Southern Calif., Los Angeles) *In its* The Deep Space Network 15 Dec. 1977 p 92-94 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

Techniques of combinational algebra and computer simulation are combined to determine the number of weight 22 codewords in the (128,64) BCH code which is being studied for use on future deep-space missions. Author

N78-24173*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A HIGH-SPEED COMPUTER LINK FOR MODERATE DISTANCES AND NOISY ENVIRONMENTS **c60**
M. W. Sievers *In its* The Deep Space Network 15 Dec. 1977 p 95-99 (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

To satisfy the need for a fully duplex high-speed computer data link for the antenna automation project at DSS 13, a very simple and inexpensive scheme was employed. The link requires two coaxial cables over which is sent a unipolar digital frequency modulated signal in which a logical 1 has twice the frequency of a logical 0. Optical isolators and filters reduce ground loop effects and increase noise immunity. Tests conducted in various environments and over different cable lengths at JPL, DSS 14 and DSS 13 have indicated that the link is highly effective. Author

N78-24174*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSS 13 AUTOMATED ANTENNA POINTING SUBSYSTEM PHASE 1 HARDWARE **c32**
M. W. Sievers *In its* The Deep Space Network 15 Dec. 1977 p 100-109 ref (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

An automated antenna pointing subsystem (APS) is being installed at DSS 13 as part of the unattended station project. The function of the APS is to track an instructed position with the 26 meter antenna and to monitor the antenna servo system and meteorological conditions to ensure a proper operational environment. This article discusses the now-completed first phase of the digital hardware portion of the APS development. Author

N78-24175*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL HIGH DENSITY (80 Mb/s) TAPE **c35**
M. D. Donner *In its* The Deep Space Network 15 Dec. 1977 p 110-118 (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 14E

Work with a state-of-the-art high density PCM tape recorder reproducer system is described. The tape recorder is designed for 80 Mb/s operation at an overall bit error rate of .00001 and for 40 Mb/s operation at .000001. The article describes the process of measuring the error rate. Also detailed is a data rate buffer designed for use in recent radar experiments and generalizable to most potential uses of the recorder system. Author

N78-24176*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DYNAMIC SPARES PROVISIONING FOR THE DSN **c81**
I. Eisenberger and G. Lorden *In its* The Deep Space Network 15 Dec. 1977 p 119-124 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 05A

A method is proposed to maintain cost-effective spares stockpiles for an entire DSN station or complex as new modules or subsystems are continuously added. Levels of spares are calculated individually for each new module type so as to conform to an established standard for the entire spares pool. Finding the spares levels is computationally simplified and in many cases is reduced to consulting a Down-Time Ratio Chart. A simple modification permits taking into account a criticality factor. Author

N78-24177*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PLANETARY ATMOSPHERE MODELING AND PREDICTIONS **c91**
A. L. Berman *In its* The Deep Space Network 15 Dec. 1977 p 125-129 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 03B

The capability to generate spacecraft frequency predictions which include the refractive bending effects induced during signal passage through a planetary atmosphere is a pivotal element of the DSN Radio Science System. This article describes the current implementation effort to develop planetary atmosphere modeling and prediction capability. Author

N78-24178*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EMPIRICAL MODEL FOR THE SOLAR WIND VELOCITY **c92**
A. L. Berman *In its* The Deep Space Network 15 Dec. 1977 p 130-134 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 03B

An analytic expression for the average radial component of the Solar Wind velocity between 1 solar radius and 1 AU is developed. The model is constructed by assuming the conservation of particle flow in the Solar Wind and application of a twelve-

year average measured value of the Solar Wind radial velocity at 1 AU. Author

N78-24179*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RMS ELECTRON DENSITY FLUCTUATION AT 1 AU c92
A. L. Berman *In its* The Deep Space Network 15 Dec. 1977 p 135-140 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 03B

Analytic expressions at 1 AU for the average RMS Electron Density Fluctuation and the ratio of RMS Electron Density Fluctuation to Electron Density, both as functions of the observational time scale, are constructed from average spacecraft in situ density measurements at approximately 1 AU and columnar phase fluctuation measurements over a wide variety of signal closet approach points. Additionally, the (one-dimensional) Electron Density Fluctuation spectrum and the Doppler phase fluctuation scale are derived, and various extrapolations to the region interior to 1 AU are made. Author

N78-24180*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
S-X CONVERSION FOR THE BLOCK 3 RECEIVER--EXCITER c32
R. E. Weller *In its* The Deep Space Network 15 Dec. 1977 p 141-148 ref (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

An S-X conversion modification was designed for the Block 3 receiver-exciter to be used in the 26 meter S-X Conversion Project. The description, design, specifications, and data are presented. Author

N78-24181*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TELEMETRY SYSTEM PERFORMANCE USING A MAXIMUM LIKELIHOOD CONVOLUTIONAL DECODER c17
B. Benjauthrit and R. P. Kemp *In its* The Deep Space Network 15 Dec. 1977 p 149-161 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

Results are described of telemetry system performance testing using DSN equipment and a Maximum Likelihood Convolutional Decoder (MCD) for code rates 1/2 and 1/3, constraint length 7 and special test software. The test results confirm the superiority of the rate 1/3 over that of the rate 1/2. The overall system performance losses determined at the output of the Symbol Synchronizer Assembly are less than 0.5 db for both code rates. Comparison of the performance is also made with existing mathematical models. Error statistics of the decoded data are examined. The MCD operational threshold is found to be about 1.96 db. Author

N78-24182*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CCIR PAPERS ON TELECOMMUNICATIONS FOR DEEP SPACE RESEARCH c32
N. F. DeGroot *In its* The Deep Space Network 15 Dec. 1977 p 162-183 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

A brief description is given of United States participation in the process of developing the technical basis for international allocation and regulation of the radio frequency spectrum. The telecommunication requirements for deep space research are considered. Topics include functional requirements, methods and techniques, and equipment characteristics. Author

N78-24183*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DUAL COUPLER CONFIGURATION AT DSS 14 FOR THE VOYAGER ERA c32
T. Y. Otoshi, K. B. Wallace, and R. B. Lyon *In its* The Deep Space Network 15 Dec. 1977 p 184-192 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

A description is given of the dual coupler configuration which was installed at DSS 14 for station delay calibrations during the Voyager era. The Z correction values determined for these new and previous configurations are presented. Author

N78-24184*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A HIGH-POWER DUAL-DIRECTIONAL COUPLER c33
K. B. Wallace and T. Y. Otoshi *In its* The Deep Space Network 15 Dec. 1977 p 193-206 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

A dual-directional loop coupler in WR 430 waveguide was installed at DSS 14 as part of the system to measure station range delay. This installation was necessary to provide special test translator signal injection ports for the Voyager near-earth calibration sequence, which required that the SPD maser be bypassed to prevent saturation of the receivers. The design of the dual coupler and testing of this device at high power is discussed. Author

N78-24185*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIAL BEARING MEASUREMENTS OF THE 64-m ANTENNA, DSS 14 c14
G. Gale *In its* The Deep Space Network 15 Dec. 1977 p 207-213 (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

The inspection fixtures and methods used to determine the extent of the axiumuth radial bearing deformation at the 64 m DSS 14 are described. An annular separation developed between the circular steel runner and the grout, suggesting either failure of the grout or, as the case appears to be, stretching of the circular steel runner due to the formation of rust on the runner at the grout interface. Author

N78-24186*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COST EVALUATION OF A DSN HIGH LEVEL REAL-TIME LANGUAGE c61
M. McKenzie *In its* The Deep Space Network 15 Dec. 1977 p 214-225 (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

The hypothesis that the implementation of a DSN High Level Real Time Language will reduce real time software expenditures is explored. The High Level Real Time Language is found to be both affordable and cost-effective. Author

N78-24187*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, Nov. - Dec. 1977
15 Feb. 1978 257 p
(Contract NAS7-100)
(NASA-CR-157161; JPL-PR-42-43) Avail: NTIS HC A12/MF A01 CSCL 22A

Deep Space Network progress in flight support, tracking and data acquisition research and technology, network engineering, hardware and software implementation, and operations are reported. For individual titles, see N78-24188 through N78-24211.

N78-24188*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Deep Space Network 15 Feb. 1978 p 1-3 (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 22D

The objectives, functions, and organization of the Deep Space Network are summarized; deep space station, ground communication, and network operations control capabilities are described. The network is designed for two-way communications with unmanned spacecraft traveling approximately 16,000 km (10,000 miles) from earth to the farthest planets and to the edge of our solar system. Author

N78-24189*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN COMMAND SYSTEM MARK III-78 c60
W. G. Stinnett *In its* The Deep Space Network 15 Feb. 1978 p 4-8 (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 09B

The Deep Space Network command Mark III-78 data processing system includes a capability for a store-and-forward handling method. The functions of (1) storing the command files at a Deep Space station; (2) attaching the files to a queue; and (3) radiating the commands to the spacecraft are straightforward. However, the total data processing capability is a result of assuming worst case, failure-recovery, or nonnominal operating conditions. Optional data processing functions include: file erase, clearing the queue, suspend radiation, command abort, resume command radiation, and close window time override. Author

N78-24190*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN GROUND COMMUNICATIONS FACILITY c14
R. H. Evans *In its* The Deep Space Network 15 Feb. 1978 p 9-17 (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 22D

A functional description of the ground communications facility and its relationships with other elements of the Deep Space network and the world-wide NASA communications network (NASCOM) is presented together with development activities and goals and comments on implementation activities in support of flight projects. Author

N78-24191*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING EXTENDED MISSION SUPPORT c14
T. W. Howe *In its* The Deep Space Network 15 Feb. 1978 p 18-23 (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 22D

The status of the Viking Deep Space Network Mark 3 '77 data subsystem implementation project and related testing at DSS 42/43 from 1 September through 31 October 1977 are reported. The Viking DSN discrepancy reporting system, Viking command support, tracking support, and periodic tests conducted with the Viking spacecraft are also discussed. Author

N78-24192*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT c14
P. S. Goodwin and G. M. Rockwell *In its* The Deep Space Network 15 Feb. 1978 p 24-28 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 22D

Activities of the Deep Space Network Operations organization in support of the Helios Project from 15 October 1977 through 15 December 1977 are described. Topics covered include: (1) Mark 3 data subsystem testing at the conjoint Deep Space Stations (DSS) 42/43 (Canberra, Australia); (2) MDS implementation at DSS 61/63 (Madrid, Spain); (3) Radio Science update, and (4) other mission-related activities. Author

N78-24193*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ESTIMATE OF PROCESSION AND POLAR MOTION ERRORS FROM PLANETARY ENCOUNTER STATION LOCATION SOLUTIONS c43
G. E. Pease *In its* The Deep Space Network 15 Feb. 1978 p 29-49 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 08B

Jet Propulsion Laboratory Deep Space Station (DSS) location solutions based on two JPL planetary ephemerides, DE 84 and DE 96, at eight planetary encounters were used to obtain weighted least squares estimates of precession and polar motion errors. The solution for precession error in right ascension yields a value of 0.3 X 10 to the minus 5 power plus or minus 0.8 X 10 to the minus 6 power deg/year. This maps to a right ascension error of 1.3 X 10 to the minus 5 power plus or minus 0.4 X 10 to the minus 5 power deg at the first Voyager 1979 Jupiter encounter if the current JPL DSS location set is used. Solutions for precession and polar motion using station locations based on DE 84 agree well with the solution using station locations referenced to DE 96. The precession solution removes the apparent drift in station longitude and spin axis distance estimates, while the encounter polar motion solutions consistently decrease the scatter in station spin axis distance estimates. Author

N78-24194*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A DEMONSTRATION OF DUAL SPACECRAFT TRACKING CONDUCTED WITH THE VIKING SPACECRAFT DURING THE APPROACH PHASE c17
C. C. Chao *In its* The Deep Space Network 15 Feb. 1978 p 50-66 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 22A

The potential improvements in navigation capability of dual spacecraft tracking were demonstrated using Viking approach data. Under unfavorable conditions of large plasma noise, low spacecraft declination and large earth-spacecraft distance, the dual spacecraft tracking technique improved the Viking B approach accuracy based on short-arc radio metric data, by a factor of 7, to less than 200 km at Mars orbit insertion minus 3 days. From the results of an analytical expansion and the Viking demonstration with a large intentional error in Mars ephemeris, that dual spacecraft data types are shown to be insensitive to ephemeris error. Results also reveal the potential reduction of tracking time requirements during planet approach. Author

N78-24195*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FREQUENCY SELECTION AND CALIBRATION OF A WATER VAPOR RADIOMETER c35
S. C. Wu *In its* The Deep Space Network 15 Feb. 1978 p 67-81 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 14B

The calibration coefficients of existing water vapor radiometers are dependent upon meteorology profiles. This is shown to be due mainly to incorrect frequency pairs. By properly selecting an optimum frequency pair, the dependency can be reduced to a relatively small amount which can be handily adjusted by surface measurement alone. Hence, a universal calibration equation is applicable to all environmental conditions - site, seasonal and diurnal variations. Optimum frequency pairs are systematically searched. Error analysis indicates that calibration for the water vapor phase delay accurate to less than 2 cm is possible at all elevation angles greater than 15 degrees. Author

N78-24196*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MISSION APPLICATIONS OF THE DUAL SPACECRAFT TRACKING TECHNIQUE c17
C. C. Chao and J. P. McDanell *In its* The Deep Space Network 15 Feb. 1978 p 82-89 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 22A

The potential application of the dual spacecraft tracking technique to the Voyager mission is discussed. The concept and technology status is reviewed and results pertaining to the JSX-Uranus option Saturn encounter, where potential navigation benefits are greatest, are presented. Results for a Jupiter encounter demonstration also are given and, finally, software modifications and tracking requirements are examined. Author

N78-24197*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRELIMINARY DESIGN WORK ON A DSN VLBI CORRELATOR c35
W. A. Lushbaugh and J. W. Layland *In its* The Deep Space Network 15 Feb. 1978 p 90-98 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 14B

The Deep Space Network is in the process of fielding high-density digital instrumentation recorders for support of the Pioneer Venus 1978 entry experiment and other related tasks. It has long been obvious that these recorders would also serve well as the recording medium for very long base interferometry (VLBI) experiments with relatively weak radio sources, provided that a suitable correlation processor for these tape recordings could be established. The overall design and current status of a VLBI correlator designed to mate with these tape recorders are described. Author

N78-24198*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THREE-CHANNEL INTEGRATING ANALOG-TO-DIGITAL CONVERTER c60
G. L. Stevens *In its* The Deep Space Network 15 Feb. 1978 p 99-104 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 09B

A three-channel integrating analog-to-digital converter was added to the complex mixer system to accept the baseband, complex signals generated by the complex mixers and output binary data to the digital demodulator for further processing and recording. The converter was first used for processing multistation data in radar experiments in the spring of 1977. Author

N78-24199*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE ROLE OF INTEREST AND INFLATION RATES IN LIFE-CYCLE COST ANALYSIS c83
I. Eisenberger, D. S. Remer, and G. Lorden (Calif. Inst. of Technol.) *In its* The Deep Space Network 15 Feb. 1978 p 105-109 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 05C

The effect of projected interest and inflation rates on life cycle cost calculations is discussed and a method is proposed

for making such calculations which replaces these rates by a single parameter. Besides simplifying the analysis, the method clarifies the roles of these rates. An analysis of historical interest and inflation rates from 1950 to 1976 shows that the proposed method can be expected to yield very good projections of life cycle cost even if the rates themselves fluctuate considerably. Author

N78-24200*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEEP SPACE TELECOMMUNICATIONS AND THE SOLAR CYCLE: A REAPPRAISAL **c32**
A. L. Berman *In its* The Deep Space Network 15 Feb. 1978 p 110-124 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 17B

Observations of density enhancement in the near corona at solar cycle (sunspot) maximum have rather uncritically been interpreted to apply equally well to the extended corona, thus generating concern about the quality of outer planet navigational data at solar cycle maximum. Spacecraft have been deployed almost continuously during the recently completed solar cycle 20, providing two powerful new coronal investigatory data sources: (1) in-situ spacecraft plasma measurements at approximately 1 AU, and (2) plasma effects on monochromatic spacecraft signals at all signal closest approach points. A comprehensive review of these (solar cycle 20) data lead to the somewhat surprising conclusions that for the region of interest of navigational data, the highest levels of charged particle corruption of navigational data can be expected to occur at solar cycle minimum, rather than solar cycle maximum, as previously believed. Author

N78-24201*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GROUND TRACKING SYSTEM PHASE FLUCTUATION SPECTRA **c92**
A. L. Berman *In its* The Deep Space Network 15 Feb. 1978 p 125-128 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 03B

Spectral analysis of solar wind plasma fluctuation requires knowledge of the average ground tracking system phase fluctuation spectrum. Typical ground tracking system phase fluctuation spectra are presented as deduced from two-way S-band Doppler noise measured at large Sun-Earth-Probe angles. Author

N78-24202*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SYSTEM PERFORMANCE TESTING OF THE DSN RADIO SCIENCE SYSTEM, MARK 3-78 **c32**
A. L. Berman and J. S. Mehta *In its* The Deep Space Network 15 Feb. 1978 p 129-133 (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 17B

System performance tests are required to evaluate system performance following initial system implementation and subsequent modification, and to validate system performance prior to actual operational usage. Non-real-time end-to-end Radio Science system performance tests are described that are based on the comparison of open-loop radio science data to equivalent closed-loop radio metric data, as well as an abbreviated Radio Science real-time system performance test that validates critical Radio Science System elements at the Deep Space Station prior to actual operational usage. Author

N78-24203*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A FAST DFT ALGORITHM USING COMPLEX INTEGER TRANSFORMS **c91**
I. S. Reed (Univ. of Southern Calif., Los Angeles) and T. K. Truong *In its* The Deep Space Network 15 Feb. 1978 p 134-140 refs Sponsored in part by AFOSR (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 09B

Winograd's algorithm for computing the discrete Fourier transform is extended considerably for certain large transform lengths. This is accomplished by performing the cyclic convolution, required by Winograd's method, by a fast transform over certain complex integer fields. This algorithm requires fewer multiplications than either the standard fast Fourier transform or Winograd's more conventional algorithms. Author

N78-24204*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRANSFORM DECODING OF REED-SOLOMON CODES OVER GF(2 TO THE 2n POWER USING THE TECHNIQUES OF WINOGRAD **c61**
I. S. Reed (Univ. of Southern Calif., Los Angeles), T. K. Truong, and B. Benjauthrit *In its* The Deep Space Network 15 Feb. 1978 p 141-163 refs (For availability see N78-24187 15-12) (Grant AF-AFOSR-2798-75)
Avail: NTIS HC A12/FM A01 CSCL 09B

An algorithm for computing a Fourier-like transform over GF(2 to the (second power) to the n power), where n = 1,2,3,4,5, was developed to encode and decode and Reed-Solomon (RS) codes of length 2 to the (second power) to the n power. Such as RS detector is considerably faster than a decoder that uses the conventional fast transform over GF(2 to the (second power) to the n power). Author

N78-24205*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CCIR PAPERS ON TELECOMMUNICATIONS FOR DEEP SPACE RESEARCH **c32**
N. F. DeGroot *In its* The Deep Space Network 15 Feb. 1978 p 164-179 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 17B

Mission requirements, equipment factors, and link performance define the frequency bands that are preferred for deep space research using manned and unmanned spacecraft. The preferred bands and selection considerations are presented. Author

N78-24206*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIO FREQUENCY INTERFERENCE BETWEEN SPACECRAFT IN DIFFERENT MISSIONS **c32**
N. F. DeGroot *In its* The Deep Space Network 15 Feb. 1978 p 180-184 (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 20N

The possibility of separately receiving signals transmitted in a common frequency band from spacecraft in different missions was studied. For the mission pairs that were examined, co-channel operation without interference is generally possible. For some mission pairs, co-channel interference would occur during brief post-launch periods. Author

N78-24207*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK OPERATIONS CONTROL CENTER BLOCK 3 MODIFICATIONS **c14**
E. A. Garcia *In its* The Deep Space Network 15 Feb. 1978 p 185-196 (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 22D

The Network Operations Control Center (NOCC) Block 3 configuration is in the process of being upgraded to provide the capabilities required to support Voyager and Pioneer Venus 1978 Project commitments as well as to support Deep Space Station changes arising from the Mark 3 DSN Data Subsystem implementation. Information is given on the hardware and software changes necessary to implement such capabilities. Author

N78-24208*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PREDETECTION TELEMETRY ANALOG RECORDING AND PLAYBACK FOR PIONEER VENUS 1978 **c17**
S. S. Kent *In its* The Deep Space Network 15 Feb. 1978 p 197-203 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 17B

Prediction telemetry recording and playback capability was implemented in the DSN to meet PV-78 mission requirements. Test data, along with theoretical considerations, gives assurance that the data degradation commitment of 1.5 db will be met, and it is anticipated that in actual performance the design goal of 1.0 db will be met. The major technical problems requiring solution were elimination of image in the OLR and the reduction of analog recorder instabilities. These were solved through the use of single-sideband mixing techniques and the use of newer generation analog recorders. Author

N78-24209*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NASTRAN ANALYSIS OF A WHEEL-RAIL LOADING ON ITS FOUNDATION **c39**
M. S. Katow *In its* The Deep Space Network 15 Feb. 1978 p 204-215 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 20K

One type of azimuth bearing for a large ground antenna (100 m) will consist of steel wheels, mounted at four corners

of the alidade, rolling on a circular flat rail which provides the vertical restraints; a radial constraining bearing at the center of the alidade provides the horizontal restraints. One important design feature is the compressive stresses in the grout or concrete foundation under the wheel-rail load. A finite element analysis check was made of a particular design that consists of a steel rail resting on a concrete foundation. Symmetry was assumed as much as possible in order to minimize the models, but meaningful element sizes were used. Recently developed isoparametric hexahedron elements available in the NASTRAN computing program, which minimizes the number of elements required while maintaining the accuracy of the computed stresses, were used with two versions of NASTRAN. Test cases to check with the analytical solutions were made. A side loading was also applied to calculate the increase in the concrete stresses. Author

N78-24210*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EMPIRICAL SPECTRAL BANDWIDTH MODEL FOR SUPERIOR CONJUNCTION **c32**
R. S. Rockwell *In its* The Deep Space Network 15 Feb. 1978 p 216-223 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 20N

The downlink signal from spacecraft in superior solar conjunction phases suffers a great reduction in signal-to-noise ratio. Responsible in large part for this effect is the line broadening of the signal spectrum. An analytic empirical expression was developed for spectral bandwidth as a function of heliocentric distance from 1 to 20 solar radii. The study is based on spectral broadening data obtained from the superior conjunctions of Helios 1 (1975), Helios 2 (1976), and Pioneer 6 (1968). The empirical fit is based in part on a function describing the electron content in the solar corona. Author

N78-24211*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN SYSTEM PERFORMANCE TEST SOFTWARE **c61**
M. Martin *In its* The Deep Space Network 15 Feb. 1978 p 224-251 (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 09B

The system performance test software is currently being modified to include additional capabilities and enhancements. Additional software programs are currently being developed for the Command Store and Forward System and the Automatic Total Recall System. The test executive is the main program. It controls the input and output of the individual test programs by routing data blocks and operator directives to those programs. It also processes data block dump requests from the operator. Author

N78-24212*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, Jan. - Feb. 1978
15 Apr. 1978 319 p refs
(Contract NAS7-100)
(NASA-CR-157110; JPL-PR-42-44) Avail: NTIS HC A14/MF A01 CSCL 22D

Progress in flight project support, tracking and data acquisition (TDA) research and technology, network engineering, hardware and software implementation, and operations are reported. For individual titles, see N78-24213 through N78-24244.

N78-24213*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES **c14**
N. A. Renzetti *In its* The Deep Space Network 15 Apr. 1978 p 1-3 (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

The objectives, functions, and organization of the Deep Space Network are summarized. Deep Space Station, Ground Communication, and Network Operations Control capabilities are described. Author

N78-24214*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TEST AND TRAINING SYSTEM, MARK 3-77 **c14**
H. C. Thorman *In its* The Deep Space Network 15 Apr. 1978 p 4-15 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

Implementation of the Deep Space Network (DSN) Test and Training System, Mark 3-77, throughout the network is described. The Mark 3-77 system is configured to support DSN testing and training for the Pioneer-Venus 1978 mission and all on-going, in-flight missions. The DSN Test and Training System capabilities include functions performed in the Deep Space Stations, Ground Communications Facility, and Network Operations Control Center. Author

N78-24215*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VOYAGER SUPPORT **c14**
R. Morris *In its* The Deep Space Network 15 Apr. 1978 p 16-33 ref (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

The Deep Space Network's tracking and data acquisition support for the Voyager Project is summarized. Prelaunch operations are included as well as flight support. A brief mission-spacecraft description is given. Author

N78-24216*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING EXTENDED MISSION SUPPORT **c14**
T. W. Howe *In its* The Deep Space Network 15 Apr. 1978 p 34-43 (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

The Deep Space Network's (DSN) support of Viking spacecraft activities is reported. The DSN discrepancy reporting system, Viking command support, and tracking support are included. The status of Viking DSN Mark 3 data subsystem implementation project related testing is reviewed. Author

N78-24217*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER MISSION SUPPORT **c14**
T. P. Adamski *In its* The Deep Space Network 15 Apr. 1978 p 44-49 ref (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

Activities within the Deep Space Network in support of the Pioneer Project's in-flight spacecraft are reported. The amount of tracking coverage provided by the Network and a summary of operational testing of the Mark 3 Data Subsystems at Deep Space Stations 42/43 and 61/63 are presented. Author

N78-24218*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT **c14**
P. S. Goodwin, W. N. Jensen, and G. M. Rockwell *In its* The Deep Space Network 15 Apr. 1978 p 50-53 ref (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

Activities of the Deep Space Network Operations Organization in support of the Helios Project are reported. Mark 3 Data Subsystems testing at the Deep Space Station and other mission related activities are included. Author

N78-24219*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN ALTERNATE TECHNIQUE FOR NEAR-SUN RANGING **c32**
J. W. Layland *In its* The Deep Space Network 15 Apr. 1978 p 54-62 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 20N

Measurement of the round trip propagation time to a spacecraft when the signal path passes by the Sun is considered. High noise, time varying signal delay, and scintillation in the solar corona are among the factors discussed. A system which matches the processing bandwidth to the dynamical conditions of the near-Sun signal path to improve performance and processes the signal off line after the signal is open-loop digitized and recorded is described and its performance estimated. Author

N78-24220*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE TONE GENERATOR AND PHASE CALIBRATION IN VLBI MEASUREMENTS **c35**
J. B. Thomas *In its* The Deep Space Network 15 Apr. 1978 p 63-74 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 14B

Unknown and unstable phase effects due to instrumentation which degrade the measurements of geophysical/astrometric quantities and clock synchronization are discussed. A tone generator used to remove these phase effects and to allow absolute calibration of the interferometer phase so that clock synchronization is possible is described. A nonrelativistic mathematical model which describes the calibration signal, its processing, and its

use in removing instrumental effects from interferometer phase is presented. Author

N78-24221*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN ANALYSIS OF VIKING S-X DOPPLER MEASUREMENTS OF SOLAR WIND COLUMNAR CONTENT FLUCTUATIONS **c92**
P. S. Callahan *In its* The Deep Space Network 15 Apr. 1978 p 75-81 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 03B

More than 320 passes of Viking S-X Doppler data are used to investigate columnar content fluctuations in the solar wind from 19 August, 1976 to 28 February, 1977. These data are used to estimate the power spectrum and radial dependence of solar wind density fluctuations. It is found that: (1) the electron density fluctuations decline with heliocentric distance; (2) the power spectrum depends on fluctuation frequency. These results are used to predict range change as a function of time scale and Sun-Earth-probe angle. Changes of interest of advanced navigation techniques are found to be likely. Author

N78-24222*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A METHOD FOR MEASURING GROUP TIME DELAY THROUGH A FEED HORN **c32**
T. Y. Otoshi, R. B. Lyon, and M. Franco *In its* The Deep Space Network 15 Apr. 1978 p 82-89 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 20N

A technique is described for measurement of time delay through a feed horn. The technique consists of measuring the time delay between the input and output ports of two identical horns separated by a known airpath distance. Ground multipath signals, which normally produce errors in this type of measurement, are identified and eliminated by using a time domain technique. Experimental results 2113 MHz showed good agreement with calculated values. Author

N78-24223*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN ANALYSIS OF ALTERNATE SYMBOL INVERSION FOR IMPROVED SYMBOL SYNCHRONIZATION IN CONVOLUTIONALLY CODED SYSTEMS **c64**
L. D. Baumert, R. J. McEliece, and H. VanTilborg (Technological Univ., Eindhoven, Netherlands) *In its* The Deep Space Network 15 Apr. 1978 p 90-97 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 12A

It is proposed that alternate symbols of the output of a convolutional encoder be inverted in order to guarantee the symbol synchronizer a certain richness of symbol transition. The technique is described along with convolutional codes with the property that even if alternate symbols are inverted, arbitrarily long transition free symbol streams may occur. For codes which do not exhibit this pathological behavior, an upper bound on the largest possible transition-free run is given. Author

N78-24224*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A PROTOTYPE DSN X-S BAND FEED: DSS 13 FIRST APPLICATION STATUS **c33**
W. F. Williams *In its* The Deep Space Network 15 Apr. 1978 p 98-103 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 09C

A prototype X-S band horn feed for future use at various Deep Space Network sites is described. A full scale item is completed and tests are planned. Author

N78-24225*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LAASP 100-m ANTENNA WIND PERFORMANCE STUDIES **c31**
R. Levy and M. S. Katow *In its* The Deep Space Network 15 Apr. 1978 p 104-113, refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 20K

Structural design procedures are described for the Large Antenna Station Project antenna system to meet performance requirements under gravity and wind loading. A computational method is shown for the evaluation of performance in response to wind loading. Cumulative probability distribution curves for wind loading gain reductions for 100-m-diameter antennas are developed to compare a relatively heavy baseline reflector backup structure with two lighter-weight structures; all have equivalent, acceptable performance for gravity loading. Author

N78-24226*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A PUBLIC-KEY CRYPTOSYSTEM BASED ON ALGEBRAIC CODING THEORY **c61**
R. J. McEliece *In its* The Deep Space Network 15 Apr. 1978 p 114-116 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 09B

A public-key cryptosystem which appears quite secure while at the same time allowing extremely rapid data rates, is constructed for use in multi-user communication networks, such as those envisioned by NASA for the distribution of space-acquired data. Author

N78-24227*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING LOOP AND MODULATION FORMAT CONSIDERATIONS FOR HIGH RATE TELEMETRY **c17**
J. R. Lesh *In its* The Deep Space Network 15 Apr. 1978 p 117-124 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

Tracking loops and modulation formats for Deep Space Network (DSN) telemetry rates in the tens of megasymbols per second region are considered. It is shown that for high rate telemetry, subcarriers should not be used and suppressed carrier modulation should be used. It is then shown that the current DSN receivers can be used for tracking suppressed carrier signals with only minor modifications and that normal Doppler tracking operations are unaffected by such changes. Finally, it is shown that the existing DSN, augmented by a megasymbol telemetry demodulator assembly can be used to process simultaneous high rate telemetry and ranging signals using an interplex modulation format which results in significant advantages to both telemetry and ranging. Author

N78-24228*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT SUPPORT: DSS 13 S-X UNATTENDED SYSTEMS DEVELOPMENT **c14**
E. B. Jackson *In its* The Deep Space Network 15 Apr. 1978 p 125-130 (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

AT DSS 13 (the Venus Station), the subsystems necessary for telemetry reception from spacecraft are placed under the control of an on-station supervisory computer (Station Controller) and various subsystem controllers, with control inputs originating from Network Operations Control Center (NOCC) at JPL, and monitor inputs from the various Station Subsystems available to the NOCC Operator. The controlled subsystems at DSS 13 include the Antenna and Servo, Microwave Configuration, Block III Receiver, and Subcarrier Demodulator Assembly. System concepts, overall system description, computer controlled subsystem capabilities, and system testing are discussed. Testing, with control being exercised from NOCC at JPL, performed on both Helios and Voyager spacecraft is included. Author

N78-24229*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DSN STANDARD REAL-TIME LANGUAGE **c61**
R. L. Schwartz, G. L. Fisher, and R. C. Tausworthe *In its* The Deep Space Network 15 Apr. 1978 p 131-138 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 09B

A modern high order programming language well suited to the special needs of real time programs developed for use in the Deep Space Stations and Network Operations and Control Center is described. The implementation of a standard high order language is planned in order to promote the development of real time programs with higher reliability, increased programmer productivity, language commonality, flexibility, and re-use potential, and to provide a means for reducing the current life cycle cost of Deep Space Network software. Author

N78-24230*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON DECODING OF REED-SOLOMON CODES OVER GF(32) AND GF(64) USING THE TRANSFORM TECHNIQUES OF WINOGRAD **c64**
I. S. Reed (Univ. of Southern Calif., Los Angeles), T. K. Truong, and B. Benjauthrit *In its* The Deep Space Network 15 Apr.

1978 p 139-171 refs (For availability see N78-24212 15-12) (Grant AF-AFOSR-2798-75)
Avail: NTIS HC A14/MF A01 CSCL 12A

A new algorithm for computing a transform over GF (2 to the nth power), where n = 5, 6, was developed to encode and decode Reed-Solomon (RS) codes of length (2 to the nth power) -1. Such an RS decoder was considerably faster than the conventional transform decoder over GF (2 to the nth power). Author

N78-24231*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTRON DENSITY AND DOPPLER RMS PHASE FLUCTUATION IN THE INNER CORONA **c92**
A. L. Berman *In its* The Deep Space Network 15 Apr. 1978 p 172-179 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 03B

Observations of the radial dependence of electron density and RMS phase fluctuation were used to construct a similar and symmetrical set of descriptors for the vastly different regime of the inner corona. It was concluded that the applicability of symmetrical coronal descriptors for both the inner and extended corona argued forcefully for the basic validity of the description. Author

N78-24232*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DDS RADIO SCIENCE SUBSYSTEM: REAL-TIME BANDWIDTH REDUCTION AND WIDEBAND RECORDING OF RADIO SCIENCE DATA **c92**
A. L. Berman *In its* The Deep Space Network 15 Apr. 1978 p 180-188 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 03B

Radio science experiment requirements levied by the Pioneer Venus Project have resulted in the development of a multimission radio science subsystem at the 64-m subnet. Major functional capabilities of the DSS radio science subsystem (DRS) were real time bandwidth reduction and wideband recording of radio science data. A functional description of the key characteristics, requirements, and operation of the DRS is provided. Author

N78-24233*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR WIND DENSITY FLUCTUATION AND THE EXPERIMENT TO DETECT GRAVITATIONAL WAVES IN ULTRA-PRECISE DOPPLER DATA **c32**
A. L. Berman *In its* The Deep Space Network 15 Apr. 1978 p 189-196 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

Solar wind electron density fluctuation was studied, as it applied to the experiment to detect gravitational waves in ultraprecise Doppler data. Expected two way S-band fractional frequency fluctuation at a 1000-second averaging time was considered to be approximately 3 x 10 to the -13th power, while the optimum two way X-band performance was predicted to be approximately 1 x 10 to the -14th power. It was concluded that both two way S-band and X-band will be required (simultaneously) so that the predicted two way X-band performance can be improved to a media goal of 3 x 10 to the -16th power via two way dual frequency calibration of solar wind induced density fluctuation. Author

N78-24234*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR WIND TURBULENCE MODELS EVALUATED VIA OBSERVATIONS OF DOPPLER RMS PHASE FLUCTUATION AND SPECTRAL BROADENING IN THE INNER CORONA **c92**
A. L. Berman *In its* The Deep Space Network 15 Apr. 1978 p 197-202 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 03B

Doppler noise observations in the inner corona are shown to demonstrate that Doppler noise is proportioned to integrated electron density. Similarly, spectral broadening in the inner corona is seen to be proportional to integrated density. It is concluded that the particle flux models are in disagreement with the experimental observations of Doppler noise to date, and hence are unlikely to be representative of actual solar wind processes. Author

N78-24235*# Jet Propulsion Lab Calif. Inst. of Tech., Pasadena.
ON THE SUITABILITY OF VIKING DIFFERENCED RANGE TO THE DETERMINATION OF RELATIVE Z-DISTANCE **c43**
F. B. Winn *In its* The Deep Space Network 15 Apr 1978 p 203-210 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 08B

Radiometric differenced range residuals (10 Viking orbiting spacecraft observations) were used to evaluate the current Deep Space Net adopted relative Z distance between Deep Space Station 43 and Deep Space Station 14. The Delta rho noise is approximately twice the predicted noises. This scatter in the Delta rho is most likely due to media calibration uncertainities and Deep Space Net hardware noise. These 10 Delta rho residuals yield an estimated Z distance between DSS 43 and Dss 14 of 7351803.6 n. The standard deviation of that estimate is 10.1 m. Author

N78-24236*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CCIR PAPERS ON TELECOMMUNICATIONS FOR DEEP SPACE RESEARCH **c32**
N. F. DeGroot *In its* The Deep Space Network 15 Apr. 1978 p 211-223 (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

The sharing of radio frequency bands between deep space research and other radio service was investigated. The protection criteria were also inlcuded. Author

N78-24237*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT OF A UNIFIED CRITERION FOR SOLAR COLLECTOR SELECTION **c44**
F. L. Lansing *In its* The Deep Space Network 15 Apr. 1978 p 224-235 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 10A

To assist in making engineering or management decisions, the possibility of building a single selection criterion was explored to distinquish between different solar collector subsystems for a specific application or between different complete solar-powered systems. The development of two analogous criteria are discussed. The criteria combined both performance and unit area costs, and presented the dollar per unit power and the dollar per unit energy produced from a solar plant. Typical values for current focusing and nonfocusing solar collectors were included. The first phase development showed that the criteria evaluation was in need of more data about the annual dynamic behavior of the collector subsystem only, the transit site-specific parameters such as solar flux, wind, and ambient temperature. Author

N78-24238*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPLEMENTATION OF AUTOMATED FAULT ISOLATION TEST PROGRAMS FOR MAXIMUM LIKELIHOOD CONVOLUTIONAL DECODER (MCD) MAINTENANCE **c61**
M. E. Alberda *In its* The Deep Space Network 15 Apr. 1978 p 236-244 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 09B

Automated fault isolation test programs are described that were developed to support rapid turn-around factory (or depot) level maintenance of the maximum likelihood convolution decoder (MCD). Functional requirements and detailed design characteristics are also described, along with a summary of the evaluation and testing completed so far. Author

N78-24239*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PERFORMANCE OF SOLAR-POWERED VAPOR-JET REFRIGERATION SYSTEMS WITH SELECTED WORKING FLUIDS **c44**
V. W. Chai and F. L. Lansing *In its* The Deep Space Network 15 Apr. 1978 p 245-251 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 10A

The performance of the solar-powered vapor-jet refrigeration scheme was compared with five selected working fluids: R-11, R-12, R-113, butane, and water. These fluids were selected among those able to suit both a power cycle and a refrigeration cycle. The results indicated that water has the highest coefficient of performance and differs by a wide margin compared to the other compound organic fluids at all boiler and evaporator temperatures considered. Author

N78-24240*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VOYAGER NEAR SIMULTANEOUS RANGING TRANSFERS **c32**
G. L. Spradlin *In its* The Deep Space Network 15 Apr. 1978 p 252-259 ref (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 20N

During testing of near simultaneous ranging techniques, a major shortcoming of the standard DSN uplink transfer procedure was uncovered. Use of the standard procedure resulted in loss of phase coherence between received and reference range codes for the round trip light time following a transfer. The philosophy behind, and the operational procedure developed for near simultaneous range transfer is reported for a new uplink transfer procedure that will enable the DSN to generate good range data during the interval from transmitter off to loss of the coherent downlink. Author

N78-24241*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOME DATA RELATIONSHIPS AMONG DIVERSE AREAS OF THE DSN AND JPL **c14**
R. M. Smith *In its* The Deep Space Network 15 Apr. 1978 p 260-267 ref (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

A logical level data model was used to represent real world relationships among diverse areas of the Deep Space Network (DSN) and non-DSN areas. The possibility for reduction of data redundancy was addressed. Author

N78-24242*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A NEW, NEARLY FREE, CLOCK SYNCHRONIZATION TECHNIQUE **c35**
W. H. Hietzke *In its* The Deep Space Network 15 Apr. 1978 p 268-272 (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 14B

A near real time, method for intercomplex clock synchronization is proposed. The method consisted of transmitting a symmetric frequency ramp to a spacecraft and determining the time at which the received ramp (in Doppler residuals) occured at overlapping stations. Adjusted preliminary data suggested that the accuracy of the method might be better than 0.7 microseconds. The method required no additional hardware and could be done during normal tracks. Author

N78-24243*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING OPERATIONS DURING THE VOYAGER 2 LAUNCH PHASE **c17**
J. A. Wackley and G. L. Spradlin *In its* The Deep Space Network 15 Apr. 1978 p 273-288 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

The Voyager 2 launch phase tracking operational procedures were carefully studied and conservatively designed to accommodate any launch contingency. This launch phase was marked by the first use of the Goldstone complex, including the 64 meter antenna, as the initial acquisition location. The prelaunch planning for and subsequent analysis of tracking operations during the Voyager 2 launch phase is described. Author

N78-24244*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EFFECTIVE PROCUREMENT AND FINANCIAL MANAGEMENT REPORTING SYSTEM **c81**
J. B. Rozek and F. R. Maiocco *In its* The Deep Space Network 15 Apr. 1978 p 289-310 ref (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 05A

The existing computerized Goldstone procurement and financial (GPF) management data base system is described. Sample management analysis reports are included and discussed, along with estimated cost savings and anticipated benefits of the computerized system. In general, the system structure and procedures are relevant to any company's financial and procurement data acquisition and information handling system. Test data are used to demonstrate the capability of the GPF system of programs. Author

N78-24245# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 583
18 May 1978 40 p Transl. into ENGLISH from Eastern European Journals
(JPRS-71140) Avail: NTIS HC A03/MF A01

Articles concerning research on cosmic radiation, space flight effects, lasers, minicomputers, polyethylene and weather patterns are presented. For individual titles, see N78-24246 through N78-24249.

N78-24246# Joint Publications Research Service, Arlington, Va.
BIOLOGICAL SATELLITES, STUDY OF COSMIC RADIATION DISCUSSED **c93**
Eva Misurova and Ivan Ahlers *In its* Transl. on Eastern Europe: Sci. Affairs, No. 583 (JPRS-71140) 18 May 1978 p 1-4 Transl. into ENGLISH from Tvorba (Prague), no. 12, 22 Mar. 1978 p 10 (For availability see N78-24245 15-12)
Avail: NTIS HC A03/MF A01

Experiments were performed to study the structural, functional, hereditary and biochemical changes of tissue cells sensitive to radiation induced by various radiation levels. An additional experiment was conducted to study the combined effects of radiation and weightlessness. A study was made of weightlessness caused by the absence of a gravitational field and determination of the consequences of artificial gravitation combined with other flight factors including the higher radiation level encountered in space. Author

N78-24247# Joint Publications Research Service, Arlington, Va.
PSYCHOLOGICAL EXPERIMENT ON SOYUZ 28 FLIGHT DESCRIBED
Docent Oldrich Miksik *In its* Transl. on Eastern Europe: Sci. Affairs, No. 583 (JPRS-71140) 18 May 1978 p 5-10 Transl. into ENGLISH arom Nove Slovo (Bratislava), no. 11, 16 Mar. 1978 p 21 (For availability see N78-24245 15-12)
Avail: NTIS HC A03/MF A01

The variability of the psychic state affects the cosmonauts' quality of performance, for example, their speed and facility of decision-making and the quality and quantity of work accomplished. Psychologists, therefore, directed attention particularly to observing changes in the psychic state of cosmonauts, to influences that bring about the changes as well as to optimalization of psychic conditions and their influences in order to ensure the conditions necessary to carry out the cosmic flight program and to ensure the psychic health of the cosmonaut during standard and extended cosmic flights. Author

N78-24248# Joint Publications Research Service, Arlington, Va.
INEFFICIENT DISTRIBUTION OF SCIENTIFIC INFORMATION CRITICIZED **c82**
Engr. G. Beltova *In its* Transl. on Eastern Europe: Sci. Affairs, No. 583 (JPRS-71140) 18 May 1978 p 18-22 Transl. into ENGLISH from Tekhnichesko Delo (Sofia), 25 Feb. 1978 p 1-5 (For availability see N78-24245 15-12)
Avail: NTIS HC A03/MF A01

An article is written evaluating the distribution of scientific and technical information in Bulgaria. It is pointed out that there is too much inefficiency in the information systems and that a lack of qualified information specialists contributes greatly to this inefficiency. L.S.

N78-24249# Joint Publications Research Service, Arlington, Va.
CSAV ASTRONAUTICS COMMISSION CHAIRMAN COMMENTS ON SOVIET SPACE PROGRAM
Rudolf Pesek *In its* Transl. on Eastern Europe: Sci. Affairs, No. 583 (JPRS-71140) 18 May 1978 p 30-33 Transl. into ENGLISH from Obrana Lidu (Prague), no. 10, 11 Mar. 1978 p 6 (For availability see N78-24245 15-12)
Avail: NTIS HC A03/MF A01

An interview is conducted with Dr. Rudlof Pesek, Chairman of the Astronautics Commission of the Czechoslovak Academy of Sciences. The role of Czechoslovakia in the Interkosmos Program is discussed along with cooperative efforts in space research and the direction this research is taking. L.S.

N78-25035# Joint Publications Research Service, Arlington, Va
TASS REPORTS ON PRESS CONFERENCE WITH SALYUT-6 PARTICIPANTS
In its Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 36 (JPRS-71139) 18 May 1978 p 12-20 Transl. into ENGLISH from Pravda (Moscow), 12 Apr. 1978 p 3 (For availability see N78-25031 15-99)
Avail: Issuing Activity

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N78-24250*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
SUNSPOT: A COMPUTER PROGRAM FOR PRODUCING OPTIMAL SOLAR SAIL PLANETOCENTRIC TRAJECTORIES
Lester L. Sackett Sep. 1977 103 p refs
(Contracts NAS7-100; JPL-954724)
(NASA-CR-157129; C-4947) Avail: NTIS HC A06/MF A01 CSCL 22A

The input, output and subroutines, including listings, for the SUNSPOT code are described. SUNSPOT can calculate time optimal planetocentric trajectories including orbit-to-orbit transfer and orbit to a subescape point. Trajectories about the the four inner planets can be calculated, and shadowing, oblateness, and solar motion may be included. A penalty function may be included to prevent trajectories which intersect the planet's surface.
Author

N78-24251*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
OPTIMAL SOLAR SAIL PLANETOCENTRIC TRAJECTORIES
Lester L. Sackett Sep. 1977 96 p refs
(Contracts NAS7-100; JPL-954724)
(NASA-CR-157130; R-1113) Avail: NTIS HC A05/MF A01 CSCL 22A

The analysis of solar sail planetocentric optimal trajectory problem is described. A computer program was produced to calculate optimal trajectories for a limited performance analysis. A square sail model is included and some consideration is given to a heliogyro sail model. Orbit to a subescape point and orbit to orbit transfer are considered. Trajectories about the four inner planets can be calculated and shadowing, oblateness, and solar motion may be included. Equinoctial orbital elements are used to avoid the classical singularities, and the method of averaging is applied to increase computational speed. Solution of the two-point boundary value problem which arises from the application of optimization theory is accomplished with a Newton procedure. Time optimal trajectories are emphasized, but a penalty function has been considered to prevent trajectories which intersect a planet's surface.
Author

N78-24252# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
ORBIT PREDICTION FOR THE ASTRONOMICAL NETHERLANDS SATELLITE
K. F. Wakker 1977 18 p refs Presented at the Brit. Interplanet. Soc. Conf. on Computer Tech. for Satellite Control and Data Process., Oct. 1977
Avail: NTIS HC A02/MF A01

The ANS satellite configuration is presented and its flight analyzed. The Delft orbit prediction activities are reviewed and prediction methods used are described. Prediction results tested using orbital data from the ESA TD-IA satellite, which was injected in 1972 into an orbit quite similar to the nominal ANS orbit are discussed and analyzed. Though the detailed analysis of the NAS orbit prediction is not yet finished it is concluded that from more than 1 1/2 years, orbit predictions were generated which satisfied the accuracy requirements. In addition, analysis of orbital data revealed the important effects of solar and geomagnetic disturbances on the satellite orbit.
ESA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N78-24253*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
MARS ROVER SYSTEM LOOPWHEEL DEFINITION SUPPORT Final Report
Wolfgang Trautwein Oct. 1977 86 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-954795)
(NASA-CR-157085; LMSC-HREC-TR-D497484) Avail: NTIS HC A05/MF A01 CSCL 13I

The feasibility of the loopwheel suspension system for use on a Mars roving vehicle was analyzed. Various steering concepts were evaluated and an optimum concept was identified on the basis of maximum probability of mission success. In the structural analysis of the loopwheel core and tread as the major fatigue critical components, important technology areas were identified.
Author

N78-24162*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Dec. 1977 p 1-3 (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

N78-24166*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT
P. S. Goodwin and G. M. Rockwell *In its* The Deep Space Network 15 Dec. 1977 p 34-41 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

N78-24185*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIAL BEARING MEASUREMENTS OF THE 64-m ANTENNA, DSS 14
G. Gale *In its* The Deep Space Network 15 Dec. 1977 p 207-213 (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

N78-24188*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Feb. 1978 p 1-3 (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 22D

N78-24190*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN GROUND COMMUNICATIONS FACILITY
R. H. Evans *In its* The Deep Space Network 15 Feb. 1978 p 9-17 (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 22D

N78-24191*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING EXTENDED MISSION SUPPORT
T. W. Howe *In its* The Deep Space Network 15 Feb. 1978 p 18-23 (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 22D

N78-24192*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT
P. S. Goodwin and G. M. Rockwell *In its* The Deep Space Network 15 Feb. 1978 p 24-28 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 22D

N78-24207*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK OPERATIONS CONTROL CENTER BLOCK 3 MODIFICATIONS
E. A. Garcia *In its* The Deep Space Network 15 Feb. 1978 p 185-196 (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 22D

N78-24213*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Apr. 1978 p 1-3 (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

N78-24214*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TEST AND TRAINING SYSTEM, MARK 3-77
H. C. Thorman *In its* The Deep Space Network 15 Apr. 1978 p 4-15 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

N78-24215*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VOYAGER SUPPORT
R. Morris *In its* The Deep Space Network 15 Apr. 1978 p 16-33 ref (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

N78-24216*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING EXTENDED MISSION SUPPORT
T. W. Howe *In its* The Deep Space Network 15 Apr. 1978 p 34-43 (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

N78-24217*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER MISSION SUPPORT
T. P. Adamski *In its* The Deep Space Network 15 Apr. 1978 p 44-49 ref (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

N78-24218*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT
P. S. Goodwin, W. N. Jensen, and G. M. Rockwell *In its* The Deep Space Network 15 Apr. 1978 p 50-53 ref (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

N78-24228*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT SUPPORT: DSS 13 S-X UNATTENDED SYSTEMS DEVELOPMENT
E. B. Jackson *In its* The Deep Space Network 15 Apr. 1978 p 125-130 (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

N78-24241*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOME DATA RELATIONSHIPS AMONG DIVERSE AREAS OF THE DSN AND JPL
R. M. Smith *In its* The Deep Space Network 15 Apr. 1978 p 260-267 ref (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N78-24254* National Aeronautics and Space Administration, Washington, D. C.
NASA SATELLITE TO STUDY EARTH'S OCEANS FROM SPACE
26 May 1978 56 p
(NASA-News-Release-78-77; P78-10081) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

The feasibility of using microwave instruments to scan the world's oceans from space in order to obtain scientific data for oceanographers, meteorologists, and commercial users of the seas will be demonstrated during the mission of the Seasat A satellite which will be launched into an 800 kilometer high near circular orbit by an Agena Atlas-Agena launch vehicle. The satellite configuration, its payload, and data collection and processing capabilities are described as well as the launch vehicle system. A.R.H.

N78-24255*# Little (Arthur D.), Inc., Cambridge, Mass.
IMPACTS AND BENEFITS OF A SATELLITE POWER SYSTEM ON THE ELECTRIC UTILITY INDUSTRY Final Report
B. M. Winer 14 Jul. 1977 136 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-954639)
(NASA-CR-157157; C-80020) Avail: NTIS HC A07/MF A01 CSCL 10A

The purpose of this limited study was to investigate six specific issues associated with interfacing a Satellite Power System (5 GW) with large (by present standards) terrestrial power pools to a depth sufficient to determine if certain interface problems and/or benefits exist and what future studies of these problems are required. The issues investigated are as follows: (1) Stability of Power Pools Containing a 5 GWe SPS; (2) Extra Reserve Margin Required to Maintain the Reliability of Power Pools Containing a 5 GWe SPS; (3) Use of the SPS in Load Following Service (i.e. in two independent pools whose times of peak demand differ by three hours); (4) Ownership of the SPS and its effect on SPS Usage and Utility Costs; (5) Utility Sharing of SPS related RD and D Costs; (6) Utility Liability for SPS Related Hazards. Author

N78-24256*# MacNeal-Schwendler Corp., Los Angeles, Calif.
HELIOGYRO PRELIMINARY DESIGN, PHASE 2 Final Report
19 Jan. 1978 192 p refs
(Contract JPL-954709)
(NASA-CR-157128; MS404-5) Avail: NTIS HC A09/MF A01 CSCL 22B

There are 12 blades in the Heliogyro design, and each blade is envisioned to be 8 meters in width and 7,500 meters in length. The blades are expected to be composed primarily of a thin membrane constructed of material such as Kapton film with an aluminum reflective coating on one side and an infrared emissive coating on the other. The present Phase 2 Final Report covers work done on the following six topics: (1) Design and analysis of a stowable circular lattice batten for the Heliogyro blade. (2) Design and analysis of a biaxially tensioned blade panel. (3) Definition of a research program for micrometeoroid damage to tendons. (4) A conceptual design for a flight test model of the Heliogyro. (5) Definition of modifications to the NASTRAN computer program required to provide improved analysis of the Heliogyro. (6) A User's Manual covering applications of NASTRAN to the Heliogyro. Author

N78-24257*# National Aeronautics and Space Administration, Washington, D. C.
PRINCIPAL CHARACTERISTICS OF A NATIONAL SATELLITE FOR EARTH OBSERVATION: PROJECT SPOT
Jun. 1978 49 p Transl. into ENGLISH from Report Centre Spatiale de Toulouse, France, Apr. 1978 p 1-55 Transl. by SCITRAN, Santa Barbara, Calif. Original doc. prep. by Centre Natl. d'Etudes Spatiales, Toulouse
(Contract NASw-2791)
(NASA-TM-75108) Avail: NTIS HC A03/MF A01 CSCL 22B

A preliminary user document for the French SPOT Earth mapping satellite to be operational in 1984 is presented. The mission is very similar to the LANDSAT series. Author

N78-24258*# Management and Technical Services Co., Beltsville, Md.
THE NIMBUS 6 DATA CATALOG, VOLUME 12: DATA ORBITS 9227 THROUGH 10043 Final Report, 1 May - 30 Jun. 1977
Greenbelt, Md. NASA. Goddard Space Flight Center Mar. 1978 143 p
(Contract NAS5-23740)
(NASA-CR-157108) Avail: NTIS HC A07/MF A01 CSCL 22A

Nimbus 6 was successfully launched from the Western Test Range, Vandenberg Air Force Base, California at 08 hr. 12 min. 00 sec. GMT on 12 June 1975. The orbit was nearly circular at 1093 x 1105 km. Satellite operations from launch through 14 July (orbit 425) consisted of engineering evaluation of all spacecraft systems. As a result of that effort, data reception, accountability and processing were intermittent during that period.

This volume reflects the operational changes that occurred to each individual subsystem on a bi-monthly basis. Also this volume incorporates significant findings and various subsystem summaries as detailed by the respective experimenter. During orbit 9793 (12 June 1977) Nimbus 6 successfully completed two years of operations. Author

N78-24259# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
NTS-2 INDEPENDENT STABILITY AND CONTROL ANALYSIS. VOLUME 1: TECHNICAL REPORT Final Report, Feb. 1976 - Mar. 1977
R. E. Pope, M. D. Ward, S. M. Schwantes, and J. G. Rupert 30 Mar. 1977 299 p Sponsored by SAMSO
(AD-A052633; HONEYWELL-77-SRC/17-Vol-1; F0360-24-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 22/2

Volume 1 presents the results of the NTS-2 Independent Stability and Control Analysis. Critical mission items investigated were nutation damper performance, gravity gradient rod deployment and acquisition, on-orbit performance, and rod and solar array flexibility effects. Detailed descriptions of vehicle/orbital dynamics, disturbances and control components are also presented. Author (GRA)

N78-24260# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
NTS-2 INDEPENDENT STABILITY AND CONTROL ANALYSIS. VOLUME 2: APPENDICES Final Report, Feb. 1976 - Mar. 1977
R. E. Pope, M. D. Ward, S. M. Schwantes, and J. G. Rupert 30 Mar. 1977 260 p Sponsored by SAMSO
(AD-A052634; HONEYWELL-77-SRC/17-Vol-2; F0360-24-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 22/2

Volume 2 presents appendices in this order: NTS-2 Mass Properties; One Body Mode Equations, Three Body Model, Nutation Damper Model, Attitude Control Electronics System Model, Tilted, Centered Dipole Magnetic Torque Model, Solar Torque Model, NTS-2 Gravity Gradient Rod Thermal Analysis, Details of Solar Array Flexibility Modeling, Modified NTS-2 Solar Array Torsion Model, Solar Array Torsion Modes, Solution for Response to Torque Motor Angular Accelerations, and Combined Earth Sensor Model. Author (GRA)

N78-24261# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
QUATERNIONS APPLIED TO MISSILE SYSTEMS
Charles A. Halijak Dec. 1977 45 p refs
(AD-A052232; DRDMI-T-78-19) Avail: NTIS HC A03/MF A01 CSCL 16/2

A constructive Euler's Theorem is followed by quaternion representation of missile three-dimensional rotations. The bordered matrix form is emphasized; lead vectors and transmuted equaternions speed computations. The n-th root of a quaternion is the starting point for algebraic recursions that are realized by software on a general purpose digital computer or by dedicated digital computer hardware. Appendices are concerned with error quaternions, four gimbal quaternions, and differential equation representation. Author (GRA)

N78-24262# Remtech, Inc., Huntsville, Ala.
AN INVESTIGATION OF THE AERODYNAMIC STABILIZING EFFECTIVENESS OF SEVERAL SPIT FLARE AFTERBODY CONFIGURATIONS IN THE PRESENCE OF AN UNDEREXPANDED JET PLUME AT TRANSONIC MACH NUMBERS
James R. Burt Redstone Arsenal, Ala. Army Missile Res. and Develop. Command 9 Jan. 1978 86 p
(Contract DAAK40-77-C-0008)
(AD-A052812; RTR-026-2; DRDMI-T-78-31) Avail: NTIS HC A05/MF A01 CSCL 16/4

A study of the stabilizing effectiveness of several folding, split flare afterbodies in the presence of an underexpanded jet plume is presented. Mach number was varied from 0.7 to 1.4 and angle of attack from -4 to 6 deg. It is shown that the split flare afterbody can be an effective stabilizing device for tube launched missiles. Author (GRA)

N78-24263# Harry Diamond Labs., Adelphi, Md.
SKYNET APPLICATIONS SOFTWARE PACKAGE (SASP) PROGRAMMERS' HANDBOOK, VERSION 2
Robert Puttcamp Feb. 1978 128 p refs
(AD-A052767; HDL-TR-1844) Avail: NTIS HC A07/MF A01 CSCL 09/2

The assessment of satellite vulnerability to system generated electromagnetic pulses (SGEMP) and the development of a methodology for this assessment are the prime objectives of the Defense Nuclear Agency sponsored SKYNET program. An automated procedure for this has resulted in the assembling of the SGEMP Transportable Automated Recording System (STARS) data van. The STARS is controlled by a PDP 11/40 computer using the SASP as its software implementation. This report gives a detailed description of each program and subroutine used in the SASP, excluding descriptions of purchased graphic software (Tektronix Plot-10 package and Versaplot package). It is intended to provide the programmer with the information required to effectively utilize the system. Author (GRA)

N78-24264# Harry Diamond Labs., Adelphi, Md.
SKYNET APPLICATIONS SOFTWARE PACKAGE (SASP) OPERATORS' AND USERS' HANDBOOK, VERSION 2
Walter J. Scott, John R. Hiller, and Robert Puttcamp Mar. 1978 90 p
(AD-A052766; HDL-TR-1843) Avail: NTIS HC A05/MF A01 CSCL 09/2

Data acquisition and reduction on a large-scale systems generated electromagnetic pulse (SGEMP) test program are traditionally costly and tedious. The most widely used methods of acquiring and recording the system response waveforms involve the use of oscilloscopes and cameras, the waveforms being captured on Polaroid film. This method requires that the analog waveforms(oscillograms) be digitized, usually by hand, into a computer-compatible format prior to applying automated data analysis techniques. The amount of manual data handling and the need for many skilled technicians make this an error-sensitive and costly procedure. This report presents a new procedure for capturing and processing complex SGEMP transients. The method is incorporated into an SGEMP transportable Automated Recording System (STARS). It reduces manual data handling significantly (a major source of errors); outputs data as computer compatible magnetic tapes, annotated hard copies, or both; and lessens the manpower requirements for data acquisition and processing. The software implementation, SKYNET Applications Software Package (SASP), is discussed here to provide STARS operators and users with the detailed information needed to effectively utilize the system. GRA

N78-24265# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ON-BOARD SATELLITE SIGNAL PROCESSING, VOLUME 1
L. S. Metzger 31 Jan. 1978 67 p refs
(Contract F19628-78-C-0002)
(AD-A052768; TN-1978-Vol-1; ESD-TR-78-20-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 17/2

Conventional communication satellites, using transponders, can provide high efficiency communications in an unstressed (low noise) environment between terminals of the same type. However, such satellites are not suitable for providing such capabilities as anti-jam protection or interconnectivity of messages between terminals of different types, both important for military communications purposes. On-board satellite signal processing can provide these and other capabilities. This report discusses on-board processing's advantages and costs, and shows how it can be incorporated into a system concept. Author (GRA)

N78-24266# Army Missile Research and Development Command, Redstone Arsenal, Ala. Engineering Lab.
PREDICTED LONG-TERM STORAGE EFFECTS ON THE MODEL 4841 LANCE ACCELEROMETER
Vernon A. Nieberlein 21 Nov. 1977 33 p refs
(DA Proj. 1X3-64307-D-212)
(AD-A052584; DRDMI-E-78-4) Avail: NTIS HC A03/MF A01 CSCL 14/2

The Model 4841 Lance accelerometer has experienced numerous cases where, after extended storage, gas ingestion through leaks in the oil seal caused the voltage output to drift. A solution to this problem has been to backfill the outer dust cover with xenon. The present work describes in detail several

engineering analyses undertaken to evaluate the anticipated performance of such a solution. First, the relative effectiveness of the O-ring seal versus the Loctite seal is investigated. Then, detailed calculations are made which lead to predictions of storage lifetimes as a function of the leak size in the outer dust cover. Finally, an analysis is made which shows the effect of a leaky float box and predicts the internal pressure in the float as a function of time. Author (GRA)

N78-24267# Rome Univ. (Italy). School of Aerospace Engineering.
ELASTIC FLEXIBILITY EFFECT ON SATELLITE JET CONTROL
L. Balis-Crema, R. Barboni, M. Marchetti, and P. Santini May 1977 36 p refs In ITALIAN; ENGLISH summary
(Contract CNR/SAS-76.0028/115.28)
(Quad-Calc-Elett-22) Avail: NTIS HC A03/MF A01

The effect of flexible booms of a telecommunication satellite on the attitude control system by thrustor on-off with an angular dead-zone is dealt with. The model concerns a one-axis control, with few elastic degrees of freedom. A simulation program and some results, for one elastic degree of freedom, is presented. Author (ESA)

N78-24268# Engins Matra, Velizy (France).
STUDY OF ATTITUDE ACQUISITION SYSTEMS BASED ON MOMENTUM EXCHANGE
P. Peyrot and J. J. Runavot (CNES, Toulouse) Paris ESA Jan. 1978 406 p refs
(Contract ESTEC-2842/76-NL-AK(SC))
(ESA-CR(P)-1047) Avail: NTIS HC A18/MF A01

Attitude acquisition of a geostationary satellite by angular momentum exchange was studied for a satellite of the OTS size. The various acquisition and reacquisition sequences were analyzed in detail: spin axis reorientation and partial despin, wheel spin up and nutation damping about the wheel axis, and earth acquisition around the wheel axis. The wheel spin up analysis has demonstrated the possibility of achieving small final nutation angles in the acquisition phase through quasi-constant wheel spin up torque profiles. This does not appear to be possible for reacquisition involving any initial conditions. Nutation damping about the wheel axis was analyzed. Passive damping appears an attractive solution for acquisition but gives a poor performance in reacquisition. Active damping with a tilted fixed momentum wheel imposes implementation constraints and has limited performances. Active damping with a single degree of freedom is adequate for both acquisition and reacquisition and shows some simplifications with respect to the OTS and ECS designs. Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N78-24269*# Tennessee State Univ., Nashville. Dept. of Mechanical Engineering.
ANALYSIS OF SHOCK PULSES FOR ENVIRONMENTAL TESTS Final Report
J. Richard Houghton 26 Aug. 1977 38 p
(Grant NsG-8012)
(NASA-CR-156927) Avail: NTIS HC A03/MF A01 CSCL 22B

Specifications for shock testing of components that will be used on the Space Shuttle vehicles require very high acceleration levels. A special shock machine was built for testing of rocket components to determine if they can meet the specified accelerations. Calibrations of transducers and methods to monitor the shock tests raised several signature-analysis questions. In this report, calibration capabilities of shock accelerometers are found to be limited to 10,000g. Equivalency of the mechanical shock test and the rocket pyrotechnic shock are examined, and two simple relationships for equivalency are proposed. Five different pulse signature-analysis techniques are tested on analytical and experimental pulse data and recommendations are made for the signature technique which most clearly identifies the magnitude of the impulse applied to the test specimen. Author

N78-24270# Committee on Appropriations (U. S. Senate).
SPACE SHUTTLE REPROGRAMING
Washington GPO 1978 56 p refs Hearing before a subcomm. of the Comm. on Appropriations, 95th Congr., 1st Sess., 1 Dec. 1977
(GPO-20-028) Avail: Comm. on Appropriations

A proposed NASA reprogramming of funds from space shuttle production into shuttle design, development, test, and evaluation is considered. Cost overrun, delays in shuttle implementation, and performance considerations are among the factors discussed. The status of the space shuttle program is reviewed including progress in development testing, test firing of the solid rocket booster, and production of orbiters 4 and 5. J.M.S.

N78-24271*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER/PAYLOAD PROXIMITY OPERATIONS SES POSTSIM REPORT. LATERAL APPROACH AND OTHER TECHNIQUES
Oscar Olszewski Mar. 1978 112 p refs
(NASA-TM-79450; JSC-13913; Rept-78-FM-16) Avail: NTIS HC A06/MF A01 CSCL 22A

Various approach and stationkeeping simulations (proximity operations) were conducted in the Shuttle engineering simulator (SES). This simulator is the first to dynamically include the Orbiter reaction control system (RCS) plume effects on a payload being recovered after rendezvous operations. A procedure for braking, using the simultaneous firing of both jets, was evaluated and found very useful for proximity operations. However this procedure is very inefficient in the RCS usage and requires modifications to the digital autopilot (DAP) software. A new final approach, the lateral approach technique (LAT), or the momentum vector proximity approach, was also evaluated in the simulations. The LAT, which included a tailfirst approach for braking, was evaluated successfully with both inertial and gravity stabilized payloads. Author

N78-24272*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
PRIMARY REACTION CONTROL SYSTEM/REMOTE MANIPULATOR SYSTEM INTERACTION WITH LOADED ARM. SPACE SHUTTLE ENGINEERING AND OPERATIONS SUPPORT
E. C. Taylor and J. D. Davis 23 May 1978 54 p refs
(Contract NAS9-15550)
(NASA-CR-151721; Working-Paper-1.4-7-229) Avail: NTIS HC A04/MF A01 CSCL 22B

A study of the interaction between the orbiter primary reaction control system (PRCS) and the remote manipulator system (RMS) with a loaded arm is documented. This analysis was performed with the Payload Deployment and Retrieval Systems Simulation (PDRSS) program with the passive arm bending option. The passive-arm model simulates the arm as massless elastic links with locked joints. The study was divided into two parts. The first part was the evaluation of the response of the arm to step inputs (i.e. constant jet torques) about each of the orbiter body axes. The second part of the study was the evaluation of the response of the arm to minimum impulse primary RCS jet firings with both single pulse and pulse train inputs. Author

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N78-24163*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TELEMETRY SYSTEM, MARK 3-77
E. C. Gatz *In its* The Deep Space Network 15 Dec. 1977 p 4-12 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N78-24181*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TELEMETRY SYSTEM PERFORMANCE USING A MAXIMUM LIKELIHOOD CONVOLUTIONAL DECODER
B. Benjauthrit and R. P. Kemp *In its* The Deep Space Network 15 Dec. 1977 p 149-161 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N78-24194*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A DEMONSTRATION OF DUAL SPACECRAFT TRACKING CONDUCTED WITH THE VIKING SPACECRAFT DURING THE APPROACH PHASE
C. C. Chao *In its* The Deep Space Network 15 Feb. 1978 p 50-66 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 22A

N78-24196*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MISSION APPLICATIONS OF THE DUAL SPACECRAFT TRACKING TECHNIQUE
C. C. Chao and J. P. McDanell *In its* The Deep Space Network 15 Feb. 1978 p 82-89 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 22A

N78-24208*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PREDETECTION TELEMETRY ANALOG RECORDING AND PLAYBACK FOR PIONEER VENUS 1978
S. S. Kent *In its* The Deep Space Network 15 Feb. 1978 p 197-203 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 17B

N78-24227*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING LOOP AND MODULATION FORMAT CONSIDERATIONS FOR HIGH RATE TELEMETRY
J. R. Lesh *In its* The Deep Space Network 15 Apr. 1978 p 117-124 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

N78-24243*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING OPERATIONS DURING THE VOYAGER 2 LAUNCH PHASE
J. A. Wackley and G. L. Spradlin *In its* The Deep Space Network 15 Apr. 1978 p 273-288 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 22D

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N78-24273# Engins Matra, Velizy (France).
THERMAL DESIGN VERIFICATION, QUALIFICATION AND ACCEPTANCE TESTING CONCEPT FOR FUTURE LARGE SPACE OBJECTS
J. F. Arnoult and P. Rollier Paris ESA 15 Dec. 1977 95 p refs
(Contract ESTEC-3255/NL/77-HP(SC))
(N-44/85/PR/ChH; ESA-CR(P)-1039) Avail: NTIS HC A05/MF A01

Thermal testing of large space vehicles is discussed. The causes of mathematical thermal model errors and the means to determine, estimate, and reduce them, as well as how to perform thermal tests in order to achieve the qualification and acceptance test goals, were analyzed. A test philosophy for the Ariane Large Satellite (ALS) is described and discussed. The opportunity is taken to specify the testing capacity limitation of the SIMLES, which is the largest thermal test facility existing in Europe. Recommendations concerning design philosophies for large satellites which will be undertaken between 1980 and 1990 are given, bearing in mind that, if possible, building of new European test facilities must be avoided. In addition some comments are given concerning temperature limits and temperature margin definitions. Author (ESA)

N78-24274# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Thermal Section.
STUDY OF THERMAL DESIGN VERIFICATION, QUALIFICATION AND ACCEPTANCE TESTING CONCEPT FOR FUTURE LARGE SPACE OBJECTS Final Report
Weydandt and Schwarz Paris ESA 1977 133 p refs
(Contract ESTEC-3199-NL/77-HP(SC))
(ESA-CR(P)-1040) Avail: NTIS HC A07/MF A01

A test program for LIRTS, a large telescope planned to be flown with the space shuttle, is presented. The advantages and constraints for testing in existing European facilities are discussed. Improvements with regard to the availability of a large TV facility and a large solar simulator were investigated. As a result of the study it is shown that available facilities, by applying infrared test methods, will provide the possibility of performing thermal tests according to the state of the art of the measurement technique. A large TV facility and a large solar simulator will not essentially improve the test program. Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N78-24275* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MOLDED COMPOSITE PYROGEN IGNITER FOR ROCKET MOTORS Patent
Wilbur C. Heier and Melvin H. Lucy, inventors (to NASA) Issued 28 Mar. 1978 10 p Filed 20 Apr. 1976 Supersedes N76-29365 (14 - 20, p 2574)
(NASA-Case-LAR-12018-1; US-Patent-4,080,901; US-Patent-Appl-SN-678520; US-Patent-Class-102-49.7; US-Patent-Class-60-39.82E; US-Patent-Class-102-39; US-Patent-Class-102-70R; US-Patent-Class-285-192) Avail: US Patent Office CSCL 21H

A lightweight pyrogen igniter assembly including an elongated molded plastic tube adapted to contain a pyrogen charge was designed for insertion into a rocket motor casing for ignition of the rocket motor charge. A molded plastic closure cap provided for the elongated tube includes an ignition charge for igniting the pyrogen charge and an electrically actuated ignition squib for igniting the ignition charge. The ignition charge is contained within a portion of the closure cap, and it is retained therein by a noncorrosive ignition pellet retainer or screen which is adapted to rest on a shoulder of the elongated tube when the closure

cap and tube are assembled together. A circumferentially disposed metal ring is provided along the external circumference of the closure cap and is molded or captured within the plastic cap in the molding process to provide, along with O-ring seals, a leakproof rotary joint. Official Gazette of the U.S. Patent Office

N78-24276*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
TWO-DIMENSIONAL COMPUTER CODE FOR DESIGN ASSESSMENT OF SRM AFT CLOSURE ENVIRONMENT Final Report
J. A. Freeman Mar. 1978 82 p refs
(Contract NASA Order H-30540-B)
(NASA-CR-150641; LMSC-HREC-TM-D568246) Avail: NTIS HC A05/MF A01 CSCL 21H

A general interpolants method for constructing numerical analogs of the partial differential equations of continuum mechanics and which combines the best features of both finite element and finite difference methods was used in a two dimensional axisymmetric analysis of the space shutle solid motor aft closure region flowfield. The numerical technique used is discussed as well as the results of the analysis. A steady state solution for the submerged nozzle nose region indicates the development of an area gas flow recirculation near the propellant burning surface boundary and in the region of the underside of the nozzle nose. This recirculation region remains spatially fixed for successive iterations (greater than 800) of the solution. A.R.H.

N78-24277# Indian Space Research Organization, Trivandrum. Aerodynamics Div.
SECOND ORDER SHOCK EXPANSION METHOD FOR VARIOUS GEOMETRIES OF ROCKET BODIES
V. K. Goyal Bangalore, India Jul. 1977 35 p refs
(ISRO-VSSC-TR-05-77) Avail: NTIS HC A03/MF A01

The second order shock expansion method applicable to bodies of revolutions near zero lift is used to derive the relations for angle of attack derivatives of normal force and pitching moment of rocket bodies of various geometries. Theory of characteristics in combination with properties of the flow predicted by generalized shock expansion method are used to derive expression of pressure on noninclined bodies. A computer program is prepared to calculate the body contribution of angle of attack derivatives of normal force and pitching moment coefficients. The pressure distribution along the longitudinal axis of the rocket body at zero angle of attack and load distribution in the form of generalized load factor may also be computed. The program can be used for rocket bodies composed of sharp or blunt nose cones, cylinders, frustum and boattail. The angle of attack derivative of coefficient of normal force, center of pressure location, and generalized loading function distribution along the longitudinal axis of the rocket body are compared with experimental and empirical method results. The pressure distribution at zero angle of attack is compared with the method of characteristics and experimental results. Author

N78-24278*# Marquardt Corp., Van Nuys, Calif.
EVALUATION OF THE SSRCT ENGINE WITH A HYDRAZINE AS A FUEL, PHASE 1 Final Report
S. J. Minton Jan. 1978 102 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-954468)
(NASA-CR-157089; Rept-1423) Avail: NTIS HC A06/MF A01 CSCL 21H

The performance parameters for the space shuttle reaction control thruster (SSRCT) when the fuel is changed from monomethylhydrazine to hydrazine were predicted. Potential problems are higher chamber wall temperature during steady state operation and explosive events during pulse mode operation. Solutions to the problems are suggested. To conduct the analysis, a more realistic film cooling model was devised which considers that hydrazine based fuels are reactive when used as a film coolant on the walls of the combustion chamber. Hydrazine based fuels can decompose exothermally as a monopropellant and also enter into bipropellant reactions with any excess oxidizer in the combustion chamber. It is concluded that the conversion of the thruster from MMH to hydrazine fuel is feasible but that a number of changes would be required to achieve the same safety margins as the monomethylhydrazine-fueled thruster. Author

N78-24279*# Rocketdyne, Canoga Park, Calif.
PREBURNER OF STAGED COMBUSTION ROCKET ENGINE Final Report, Jul. 1975 - Dec. 1977
M. C. Yost Feb. 1978 280 p refs
(Contract NAS3-19713)
(NASA-CR-135356; RI/RD78-114) Avail: NTIS HC A13/MF A01 CSCL 21H

A regeneratively cooled LOX/hydrogen staged combustion assembly system with a 400:1 expansion area ratio nozzle utilizing an 89,000 Newton (20,000 pound) thrust regeneratively cooled thrust chamber and 175:1 tubular nozzle was analyzed, assembled, and tested. The components for this assembly include two spark/torch oxygen-hydrogen igniters, two servo-controlled LOX valves, a preburner injector, a preburner combustor, a main propellant injector, a regeneratively cooled combustion chamber, a regeneratively cooled tubular nozzle with an expansion area ratio of 175:1, an uncooled heavy-wall steel nozzle with an expansion area ratio of 400:1, and interconnecting ducting. The analytical effort was performed to optimize the thermal and structural characteristics of each of the new components and the ducting, and to reverify the capabilities of the previously fabricated components. The testing effort provided a demonstration of the preburner/combustor chamber operation, chamber combustion efficiency and stability, and chamber and nozzle heat transfer. Author

N78-24280*# Hughes Research Labs., Malibu, Calif. Ion Physics Dept.
THE 30-CM ION THRUSTER POWER PROCESSOR Final Report
B. G. Herron and D. J. Hopper Apr. 1978 77 p refs
(Contract NAS3-17223)
(NASA-CR-135401) Avail: NTIS HC A05/MF A01 CSCL 21C

A power processor unit for powering and controlling the 30 cm Mercury Electron-Bombardment Ion Thruster was designed, fabricated, and tested. The unit uses a unique and highly efficient transistor bridge inverter power stage in its implementation. The system operated from a 200 to 400 V dc input power bus, provides 12 independently controllable and closely regulated dc power outputs, and has an overall power conditioning capacity of 3.5 kW. Protective circuitry was incorporated as an integral part of the design to assure failure-free operation during transient and steady-state load faults. The implemented unit demonstrated an electrical efficiency between 91.5 and 91.9 at its nominal rated load over the 200 to 400 V dc input bus range. Author

N78-24281*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRETS USED TO MEASURE EXHAUST CLOUD EFFLUENTS FROM SOLID ROCKET MOTOR (SRM) DURING DEMONSTRATION MODEL (DM-2) STATIC TEST FIRING
Michael Susko Apr. 1978 26 p refs
(NASA-TM-78171) Avail: NTIS HC A03/MF A01 CSCL 20H

Electrets were compared with fixed flow samplers during static test firing. The measurement of the rocket exhaust effluents by samplers and electrets indicated that the Solid Rocket Motor had no significant effect on the air quality in the area sampled. The results show that the electrets (a passive device which needs no power) can be used effectively alongside existing measuring devices (which need power). By placing electrets in areas where no power is available, measurements may be obtained. Consequently, it is a valuable complementary instrument in measuring rocket exhaust effluents in areas where other measuring devices may not be able to assess the contaminants. Author

N78-24282# AeroChem Research Labs., Inc., Princeton, N. J.
A COMPUTER CODE FOR FULLY COUPLED, TWO-PHASE ROCKET NOZZLE FLOWS Final Report, 1 Nov. 1976 - 31 Jan. 1978
Roger D. Thorpe Feb. 1978 37 p refs
(Contract F49620-77-C-0016)
(AD-A052746; AeroChem-TP-368; AFOSR-78-0606TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

This report describes the development of a unified rocket nozzle computer program that is intended to serve as an aid in the study of the physical and chemical processes that control rocket exhaust plume dynamics, including plume visibility. The computer program is composed of the transonic, two-phase code of Kliegel and Nickerson and the AeroChemFULLNOZ nozzle code. This combination allows chamber conditions to be used to initiate a continuous nozzle calculation, thus eliminating the assumptions of supersonic start line gas and particle properties previously required by FULLNOZ. Sample calculations are presented for a small, conical nozzle motor burning a low smoke propellant. These calculations describe the sensitivity of the unified code to variations in start line conditions, particle sizes, mass loading, and particle drag and heat transfer coefficients.
Author (GRA)

N78-24283# Ogden Air Logistics Center, Hill AFB, Utah.
SURVEILLANCE REPORT. STAGE 1: DISSECTED MOTORS. PHASE 9: PROPELLANT AND COMPONENT TESTING
John A. Thompson Mar. 1978 97 p
(AD-A052698; MANCP-392(78)) Avail: NTIS HC A05/MF A01 CSCL 21/8

Testing was performed to determine the useful shelf/service life for LGM-30 Stage 1 Rocket Motors. A three year storage program for propellant and components was started in May 1961. This program was then extended to a ten year study and later continued indefinitely to assure that a deterioration in motor physical characteristics could be detected in time to take some corrective actions before the weapon system performance deteriorated below an acceptable level. This report covers only propellant data and limited case bond data. The malfunction of an environmental chamber destroyed component samples that had originally been part of this testing program (and the inadvertent burning of some motors during dissection reduced the material available for testing). Planned dissection of selected motors in the future will provide samples for continued component testing. GRA

N78-24284*# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT, FLIGHT PERFORMANCE, AND TEST RESULTS FOR TWO SINGLE-STAGE MALEMUTE ROCKET VEHICLES LAUNCHED AT TONOPAH TEST RANGE
William A. Millard, William R. Barton, and Emil J. Steinkraus Jul. 1977 55 p refs Sponsored in part by NASA. Goddard Space Flight Center
(Contract EY-76-C-04-0789)
(NASA-CR-157116; SAND-77-00061) Avail: NTIS HC A04/MF A01 CSCL 22B

Two recent Malemute rocket motor failures were attributed to a change in the internal ballistics of the rocket motor induced by vehicle spin. After the second failure a correlation between the outcome of all previous tests and the time history of the orientation of the total acceleration vector angle was observed. In an effort to obtain additional data to substantiate the acceleration vector angle correlation and to learn more about the Malemute spin problem in general, two single-stage Malemute rocket vehicles were launched from the Tonopah Test Range in July 1976. The results of the aeroballistic and flight performance analyses conducted in preparation for these tests, along with pertinent thrust, mass property, and aerodynamic coefficient data and the results of the tests, which were completed successfully with all objectives satisfied are presented. ERA

N78-24285# European Space Agency, Paris (France).
SEAP - CONFIGURATIONS AND COST ANALYSIS
D. Manski and L. Witbracht Apr. 1978 66 p refs Transl. into ENGLISH of 'SEAP - Konfigurations- u. Kostenanal.', DFVLR, Lampoldshausen, West Ger. Report DLR-IB-456-77/2, Jan. 1977 Original report in GERMAN previously announced as N78-18108
(ESA-TT-456; DLR-IB-456-77/2) Avail: NTIS HC A04/MF A01

An analysis of 26 different Spacelab experiment propulsion platform configurations is presented covering the determination of costs, masses, and the required volume in the shuttle payload bay. As a result of this analysis, three preferred configurations were selected: (1) hydrazine, super blowdown, isotensoid tank; (2) hydrazine, blowdown, inert gas attitude control, spherical tank; and (3) hydrazine, regulated pressurized gas system, inert gas attitude cont[illegible] spherical tank. ESA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N78-24286# Michigan Univ., Ann Arbor. Coll. of Engineering.
REPORT OF THE MATERIALS RESEARCH COUNCIL (1977)
M. J. Sinnot Aug. 1977 115 p refs
(Contract MDA903-76-C-0250; ARPA Order 2341)
(AD-A052448; UMICH-014521) Avail: NTIS HC A06/MF A01 CSCL 11/4

This report is a summary of the activities of the Materials Research Council during its annual Summer Conference held in La Jolla, California, during the period July 5-29, 1977. Currently work is going on in large space optics, non-destructive inspection, laser materials, non-equilibrium alloy structures, strong optical fibers, composite material penetrators and structural ceramics.
GRA

N78-24287# Illinois Univ., Urbana-Champaign. Dept. of Chemistry.
KINETICS OF UNIMOLECULAR DIOXETANONE CHEMILUMINESCENCE: COMPETITIVE PARALLEL REACTION PATHS
Gary B. Schuster and Steven P. Schmidt 24 Mar. 1978 16 p refs Submitted for publication
(Contract N00014-76-C-0745; NR Proj. 051-616)
(AD-A052556; TR-11) Avail: NTIS HC A02/MF A01 CSCL 07/3

The thermal unimolecular reaction of the 1-2-dioxetane ring system to generate electronically excited state carbonyl containing compounds is by far the most carefully and extensively studied of all chemiluminescent reactions. The mechanism for this intriguing transformation has been hotly debated by proponents of stepwise and concerted decomposition paths. The ammunition in this controversy ranges from purely theoretical calculations to experimental substituent, solvent, and isotope effects. Of pivotal importance to the dissection of the reaction path have been studies of kinetics and of excited state yields for variously substituted dioxetanes. GRA

N78-24288# Oak Ridge National Lab., Tenn.
MASS SPECTROMETRIC STUDY OF DISSOCIATIVE AND NONDISSOCIATIVE ELECTRON ATTACHMENT TO ORGANIC MOLECULES Ph.D. Thesis
J. P. Johnson Mar. 1977 241 p refs
(Contract W-7405-eng-26)
(TID-27708) Avail: NTIS HC A11/MF A01

Negative ion formation resulting from the attachment of low energy (less than 10eV) electrons was studied for 30 disubstituted NO2-containing benzene derivatives and ten aliphatic chlorocarbons using a time-of-flight mass spectrometer. Long-lived parent ions formed at thermal energies via nuclear-excited Feshbach resonances were observed for all the disubstituted NO2-containing benzenes and the lifetime, tau, of each was measured. The lifetimes were found to depend on the donor acceptor properties of the second substituent, the position of the second substituent with respect to NO2, and the presence of intramolecular complexing. The differences in the lifetimes of these various benzene derivatives were found to depend strongly on their electron affinities. CNDO-2 calculations were performed to show the relation between tau and pi-electron charge densities in the benzene ring. ERA

N78-24289# Oklahoma State Univ., Stillwater. Dept. of Chemistry.
HIGH PURITY PNA HYDROCARBONS AND OTHER AROMATIC COMPOUNDS: SYNTHESIS AND PURIFICATION Final Report, May 1974 - May 1977
E. J. Eisenbraun Jan. 1978 73 p refs

(Grant EPA-803097)
(PB-277469; EPA-600/2-78-006) Avail: NTIS HC A04/MF A01 CSCL 07C

The synthesis and/or purification of a group of polynuclear aromatic hydrocarbons commonly found as pollutants in the environment are described. The steps used in a given synthesis, the experiments carried out, and a presentation of some instrumental data obtained in establishing the identity and purity of the hydrocarbons are included. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N78-24290* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPRAYABLE LOW DENSITY ABLATOR AND APPLICATION PROCESS Patent
Max H. Sharpe, William E. Hill, William G. Simpson, James M. Carter, Edwin L. Brown, Harry M. King, Paul H. Schuerer, and David D. Webb, inventors (to NASA) Issued 7 Mar. 1978 8 p Filed 19 Jan. 1977 Supersedes N77-15105 (15 - 06, p 0715)
(NASA-Case-MFS-23506-1; US-Patent-4,077,921; US-Patent-Appl-SN-760809; US-Patent-Class-260-2.5B; US-Patent-Class-260-2.5BE; US-Patent-Class-260-2.5AP; US-Patent-Class-260-2.5EP; US-Patent-Class-260-2.5AK; US-Patent-Class-260-2.5FP; US-Patent-Class-260-37EP; US-Patent-Class-260-29.1R; US-Patent-Class-427-427) Avail: US Patent Office CSCL 11D

A sprayable, low density ablative composition is described consisting esentially of: (1) 100 parts by weight of a mixture of 25-65% by weight of phenolic microballoons, 0-20% by weight of glass microballoons, 4-10% by weight of glass fibers, 25-45% by weight of an epoxy-modified polyurethane resin, 2-4% by weight of a bentonite dispersing aid, and 1-2% by weight of an alcohol activator for the bentonite; (2) 1-10 parts by weight of an aromatic amine curing agent; and (3) 200-400 parts by weight of a solvent. Official Gazette of the U.S. Patent Office

N78-24291*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL BARRIER COATINGS
S. J. Grisaffe, S. R. Levine, and J. S. Clark 1978 21 p refs Presented at the 23d Ann. Intern. Gas Turbine Conf., London, 9-13 Apr. 1978; sponsored by ASME
(NASA-TM-78848) Avail: NTIS HC A02/MF A01 CSCL 11D

Thermal barrier coatings offer gas turbines one way to reach fuel flexibility and improved efficiency. Test/analytical results are encouraging for this young technology. Author

N78-24292*# National Aeronautics and Space Administration, Washington, D. C.
CARBON FIBER STUDY
[1977] 43 p
(NASA-TM-79449) Avail: NTIS HC A03/MF A01 CSCL 11D

A coordinated Federal Government action plan for dealing with the potential problems arising from the increasing use of graphite fiber reinforced composite materials in both military and civilian applications is presented. The required dissemination of declassified information and an outline of government actions to minimize the social and economic consequences of proliferated composite materials applications were included. Author

N78-24293*# National Aeronautics and Space Administration, Washington, D. C.
SILICONE AZIDE FIREPROOF MATERIAL
Jun. 1978 7 p Transl. into ENGLISH of Japanese Patent 72 11,803, (Cl. C 04b) 13 Apr. 1972, Appl. 68 35,839, 27 May 1968 3 p Transl. by Sci. Transl. Serv., Santa Barbara, Calif. Original doc. prep. by Toshiba Electronics Co. Ltd., Japan
(Contract NASw-2791)
(NASA-TM-75254) Avail: NTIS HC A02/MF A01 CSCL 11D

Finely powdered titanium oxide was added to silicone azide as the sintering agent to produce a nonflammable material. Mixing proportions, physical properties, and chemical composition of the fireproofing material are included. J.A.M.

N78-24294# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
MEASUREMENT AND INTERPRETATION OF THE TEMPERATURE DEPENDENCE IN MAGNETIC SUSCEPTIBILITY OF PARAMAGNETIC SANDWICH COMPOUNDS Ph.D. Thesis [MESSUNG UND INTERPRETATION DER TEMPERATURABHAENGIGKEIT DER MAGNETISCHEN SUSZEPTIBILITAET VON PARAMAGNETISCHEN SANDWICHVERBINDUNGEN]
Niklaus Oswald 1977 287 p refs In GERMAN; ENGLISH summary
(Diss-5922) Avail: NTIS HC A13/MF A01

An already existing apparatus was further developed that enabled establishment of the force change of the sample in the magnet either by automatic continuous control or in separate steps from 4.2 to 300 K during a given time. The methods of Gouy and of Faraday were used. The results were computerized such that they were given both in tabular and in graphical form. Several representatives of the d4,d5,d7 and d8 metallocenes which had not been extensively investigated previously were synthesized and then diluted in various host-matrices (mostly by cosublimation method) and measured with the magnetic balance. Author

N78-24295*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
THE COMPRESSIVE FAILURE OF GRAPHITE/EPOXY PLATES WITH CIRCULAR HOLES Interim Report
James F. Knauss, James H. Starnes, Jr. (NASA. Langley Res. Center), and Edmund G. Henneke, II Feb. 1978 116 p refs (Grant NGR-47-004-129)
(NASA-CR-157115; IR-11; VPI-e-78-5) Avail: NTIS HC A06/MF A01 CSCL 11D

The behavior of fiber reinforced composite plates containing a circular cutout was characterized in terms of geometry (thickness, width, hole diameter), and material properties (bending/extensional stiffness). Results were incorporated in a data base for use by designers in determining the ultimate strength of such a structure. Two thicknesses, 24 plies and 48 plies were chosen to differentiate between buckling and strength failures due to the presence of a cutout. Consistent post-buckling strength was exhibited by both laminate configurations. Author

N78-24296# Naval Surface Weapons Center, White Oak, Md. Dept. of Research and Technology.
THE EFFECT OF MOISTURE ON CARBON FIBER REINFORCED COMPOSITES. 4: PREDICTION OF CHANGES IN THE ELASTIC BEHAVIOR Technical Report, 1 May - 3 Dec. 1976
J. M. Augl and A. E. Berger 26 Sep. 1977 56 p refs (WR0220401)
(AD-A051841; NSWC/WOL/TR-77-61) Avail: NTIS HC A04/MF A01 CSCL 11/2

The changes in the elastic behavior of composites due to the reversible moisture absorption can be predicted when the matrix properties (E sub m and Nu sub m) have been determined as a function of temperature and moisture concentration. The composite is analyzed in terms of artificial delta-layers, analogous to laminated plate theory. If, in addition, the diffusion coefficient of moisture for the composite is known as a function of temperature, one can predict the elastic behavior for any 'reasonable' environment as a function of time. Author (GRA)

N78-24297# Martin Marietta Aerospace, Orlando, Fla.
SUBSCALE DEVELOPMENT OF ADVANCED ABM GRAPHITE/EPOXY COMPOSITE STRUCTURE Final Report, 1 Aug. 1975 - 30 Nov. 1976
Frank H. Koo and Joseph P. Seinberg Jan. 1978 193 p refs (Contract DAAG46-75-C-0097; DA Proj. 1W1-62113-A-661)
(AD-A052438; OR-14-225; AMMRC-TR-78-4) Avail: NTIS HC A09/MF A01 CSCL 11/4

The program objective was to demonstrate by analysis fabrication, and testing of conical sections of ultra-high modulus graphite/epoxy structures that the material was applicable for utilization on future high-performance interceptors. The GY70/

Fiberite 934 ultra-high modulus unidirectional tapes were used in design of the basic shell structure in the subscale development program. Laminate design was determined by analysis to meet the required strength and stiffness. Titanium shims were used for reinforcement in the regions of the splice joints. Fabrication drawings were prepared for the basic conical shell and shells with reinforced joints. Static tests were conducted for ten basic shells to determine strength and stiffness and to establish a strength envelope under combined axial compression and bending loads. Two shock tests and two static tests were conducted on four shells with joint reinforcements. The shock tests were conducted to simulate stage separation shock. Test data were evaluated and the results and conclusions are given in this report. Author (GRA)

N78-24298# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
DEFECT-PROPERTY RELATIONSHIPS IN COMPOSITE MATERIALS, PART 2 Final Report, 3 Feb. 1975 - 3 Feb. 1977
K. L. Reifsnider, E. G. Henneke, II, and W. W. Stinchcomb Jun. 1977 55 p refs
(Contract F33615-75-C-5119; AF Proj. 7340)
(AD-A052358; AFML-TR-76-81-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 11/4

This report describes the results of an investigation of the nature of damage in two graphite-epoxy laminates under various loading histories, with special attention to the changes in mechanical properties caused by specific damage mechanisms. The results include several new findings, the development of unique investigative methods and some substantial deviations from common model predictions. Author (GRA)

N78-24299# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
PURE SILICON DIOXIDE DRAWN FIBERS AND COMPOSITE MATERIALS [LES FIBRES DE SILICE PURE ETIREE ET LES MATERIAUX COMPOSITES]
C. Nollet Paris Assoc. Aeron. et Astronautique de France 1977 20 p In FRENCH
(AAAF-NT-77-32; ISBN-2-7170-0457-2) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

Properties of fibers obtained by drawing from pure silicon dioxide melts are discussed. The mechanical properties are substantially better than those of conventional glass fibers containing 50 to 60 % SiO2. Topics include general properties of silicon dioxide glass, properties of silicon dioxide fibers, and silicon dioxide/resin composites. It is concluded that although silicon dioxide fibers do not show a marked improved specific resistance and specific rigidity compared with new fibers such as carbon, boron or, Kevlar, it is possible to produce light weight composite materials having excellent thermal insulation properties. ESA

N78-24300# Association Aeronautique et Astronautique de France, Paris.
KEVLAR 49 - EPOXY RESIN COMPOSITE. APPLICATION TO THE CONSTRUCTION OF POWDER PROPULSION SYSTEM HULLS [COMPOSITE KEVLAR 49 - RESINE EPOXY APPLICATION A LA REALISATION D'ENVELOPPES DE PROPULSEUR A POUDRE]
C. Delair 1977 59 p refs In FRENCH Presented at the Colloq. on New Mater., Bordeaux, 20-22 Apr. 1977
(AAAF-NT-77-42; ISBN-2-7170-0467-X) Avail: NTIS HC A04/MF A01; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

Kevlar 49 is particularly interesting because of its high specific resistance and, less important, specific modulus. Moreover, it can be applied when high impact resistance is required. It is shown that the manufacturing of powder propulsion system hulls by filament winding of Kevlar 49 fiber leads to significant amelioriations. ESA

N78-24301# Gulf South Research Inst., New Orleans, La.
PREPARATION OF HIGH CLEARANCE SORBENT-FILLED FIBERS Final Report, 23 Dec. 1976 - 19 Jul. 1977
Elias Klein and F. F. Holland 19 Jul. 1977 46 p refs
(Grant AM-7-2201)
(PB-277457; AK-7-2201-F) Avail: NTIS HC A03/MF A01 CSCL 11D

Filled hollow fibers were prepared and evaluated for hemosorption applications. Powered activated carbon, urease-carbon, and macroporous ion exchange resins were used as fillers in the highly permeable cellulose acetate hollow fibers. Results showed carbon-filled hollow fibers had better mass transfer properties than encapsulated carbon in solid form. Synthetic Zeolites were found to have higher specificity and capacity for ammonium ion adsorption than zirconium phosphate. Projections are that hemosorption devices utilizing urease, carbon, and Zeolites could remove all nitrogenous waste metabolites currently being treated only by dialysis. Oxystarch and oxystarch derivatives are tested for direct urea adsorption and were found to be unsuitable for this application. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N78-24302 Oregon State Univ., Corvallis.
FAST GAS CHROMATOGRAPHY Ph.D. Thesis
Raymond Dale Dandeneau 1978 133 p
Avail: Univ. Microfilms Order No. 78-06173

Porous silica microparticles designed for modern liquid chromatography have proven effective in gas chromatography. Inlet pressures up to 70 atms were needed using hydrogen as a carrier gas. The particles as received were too retentive for fast chromatography and gave asymmetric peaks. A coating of fluorosilicone oil overcame both problems but other coatings were less effective. Bonded phases proved less satisfactory on both counts and also gave substantially less efficient columns and greater flow resistance. Selectivity of the silica was found to vary between manufacturers and between different batches of silica from the same manufacturer. Column efficiency and flow resistance were sharply dependent on physical properties of the particles. Dissert. Abstr.

N78-24303*# Universities Space Research Association, Houston, Tex.
FLUID MECHANICS OF CONTINUOUS FLOW ELECTROPHORESIS Final Report
D. A. Saville (Princeton Univ.) and S. Ostrach (Case Western Reserve Univ.) Apr. 1978 96 p refs
(Contract NAS8-31349)
(NASA-CR-150689) Avail: NTIS HC A05/MF A01 CSCL 07D

The following aspects of continuous flow electrophoresis were studied: (1) flow and temperature fields; (2) hydrodynamic stability; (3) separation efficiency, and (4) characteristics of wide gap chambers (the SPAR apparatus). Simplified mathematical models were developed so as to furnish a basis for understanding the phenomena and comparison of different chambers and operating conditions. Studies of the hydrodynamic stability disclosed that a wide gap chamber may be particularly sensitive to axial temperature variations which could be due to uneven heating or cooling. The mathematical model of the separation process includes effects due to the axial velocity, electroosmotic cross flow and electrophoretic migration, all including the effects of temperature dependent properties. Author

N78-24304*# National Aeronautics and Space Administration, Washington, D. C.
STANDARDIZATION OF METHODS OF CALCULATING THE WEIGHTING FUNCTIONS ON THE BASIS OF THE PARAMETERS OF THE FINE STRUCTURE OF THE ABSORPTION BANDS OF ATMOSPHERIC GASES
May 1978 47 p Transl. into ENGLISH of "Standartizatsiya Metodov Rashcheta Vesovykh Funktsiy Na Osnove Parametrov

Tonkoy Strukury Polos Pogloshcheniya Atmosfernykh Gazov" Moscow, Acad. of Sci. USSR and Joint Sov.-Am. Working Group on Space Meteorol., Apr. 1978 46 p Transl. by Transemantics, Inc., Washington, D. C. Original doc. prep. by Acad. of Sci. USSR
(Contract NASw-2792)
(NASA-TM-75103) Avail: NTIS HC A03/MF A01 CSCL 07D

Point 7 of a list of works conducted by the USSR in accordance with the Joint Soviet-American Research Program on improving methods of heat probes from satellites is discussed. Numerous calculations of transmission functions, along with tables are enclosed. Author

N78-24305*# National Aeronautics and Space Administration, Washington, D. C.
THE SOLUTION OF ELEMENTS IN THE MOLTEN SYSTEM AlCl3-NaCl
V. O. Plotnikov and N. S. Fortunatov May 1978 10 p refs Transl. into ENGLISH from Zap. Inst. Khemiy UAN (Kiev), v. 3, no. 1, 1936 p 123-128 Transl. by SCITRAN, Santa Babara, Calif. Original doc. prep. by Acad. of Sci. of the Ukrainian SSR, Kiev
(Contract NASw-2791)
(NASA-TM-75273) Avail: NTIS HC A02/MF A01 CSCL 07D

The solubility of Hg, P, Mn, W, Mo, Cu, Si and S in molten 1:1 AlCl3 - NaCl was measured to 150-370 deg. Except with S, there is no chemical reaction between the solutes and the solvent. Author

N78-24306*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIODE LASER SATURATION SPECTROSCOPY OF NH3
D. E. Jennings May 1978 12 p refs Submitted for publication
(NASA-TM-79550) Avail: NTIS HC A02/MF A01 CSCL 07D

Saturation of molecular transitions using a tuneable diode laser was demonstrated for the first time using a standing-wave cavity configuration with an f/8 beam focussed at the sample. Observed saturation effects in NH3 transitions near 888/cm include sub-Doppler (Lamb-dip) resonances at line center.Author

N78-24307# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
THE EFFECT OF H2, N2, CO AND O2 ON CONDUCTANCE VALUES IN VAPOR DEPOSITED LAYERS OF COBALT PHTHALOCYANIN Ph.D. Thesis [DER EINFLUSS VON H2, NE, CO UND O2 AUF DEN LEITWERT VON AUFDAMPFSCHICHTEN AUS KOBALT-PHTHALOCYANIN]
Peter Weber 1976 116 p refs In GERMAN
(Diss-5744) Avail: NTIS HC A06/MF A01

The selective adsorption behavior of the metalloorganic complex CoPc was studied by exposing thin layers of the porphyrine compound to various gases and by measuring resulting changes in electrical conductivity, changes in crystal structure, and changes in molecular structure. Relative conductivity changes during adsorption of H2, N2, CO, or N2/CO as function of gas pressure showed little differentiation. Markedly slower conductivity changes were observed during exposure to O2, with a maximum at more than 100 Torr gas pressure.Transl. by G.G.

N78-24308# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
EQUILIBRIA AND KINETICS IN COMPLEX FORMATION REACTIONS OF RARE EARTHS Ph.D. Thesis [GLEICHGEWICHTE UND KINETIK VON KOMPLEXBILDUNGSREAKTIONEN DER SELTENEN ERDEN]
Robert Gehrig 1977 129 p refs In GERMAN; ENGLISH summary
(Diss-6002) Avail: NTIS HC A07/MF A01

The equilibria and kinetics (temperature jump method) of tripositive lanthanide ion complex formation reactions were investigated with several bi- and tridentate ligands. It is shown that not only 1:1-complexes, but also 1:2- as well as 1:3-complexes are present in aqueous solutions. To determine the influence of coordinated ligands on the lability of metal-water bonds, ternary complex formations of the lanthanide chelates LnY (Y = EDTA and N-(2-Hydroxyethyl)-ethylenediamine-NNN'-triacetate) with bi- and tri- dentate ligands were studied. The mechanisms and rates depend strongly on coordination numbers and coordination geometries of the lanthanide chelate complexes involved. Author

N78-24309# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
ON POISONING, MASS TRANSPORT AND PROBLEMS OF PARAMETER DETERMINATION IN THE LIQUID PHASE HYDROGENATION OF O-CRESOL BY PALLADIUM CATALYSATOR Ph.D. Thesis [UEBER VERGIFTUNG, STOFFTRANSPORT UND PROBLEME DER PARAMETERBESTIMMUNG BEI DER FLUESSIGPHASENHYDRIERUNG VON O-KRESOL AN EINEM PALLADIUM-KATALYSATOR]
Jean-Jacques Zwicky 1977 124 p refs In GERMAN; ENGLISH summary
(Diss-6035) Avail: NTIS HC A06/MF A01

The influence of poisoning and mass transport on the performance of a suspended palladium catalyst for the liquid-phase hydrogenation of o-cresol have been investigated. A special computer program has been developed to estimate the parameters of the kinetic models. The hydrogenation in the absence of poison is described by a Langmuir-Hinshelwood adsorption model with adsorption of hydrogen and substrate on different active sites of the catalyst. When poison is present in the feed, the activity loss can be described by an extended model of the same type; experimental results show that the poison is very strongly adsorbed and that there is practically no interaction between poison and substrate on the remaining catalyst surface. Rate expressions were defined for the various transport and reaction steps occurring in the three-phase slurry system and these were combined to an overall rate expression. From this, the various possible rate-limiting steps were analyzed. Author

N78-24310# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
APPLICATION OF ACTIVATED COAL FOR THE PURIFICATION OF A MULTIPLE COMPONENT CHEMICAL WASTE WATER Ph.D. Thesis [EINSATZ VON AKTIVKOHLE ZUR REINIGUNG EINES MEHRKOMPONENTENCHEMIEABWASSERS]
Markus Werner Balzli [1977] 188 p refs In GERMAN; ENGLISH summary
(Diss-5950) Avail: NTIS HC A09/MF A01

The behavior of various two and three component systems in a fixed bed column was investigated both experimentally and theoretically using model substances typical of those commonly found in industrial waste waters. Different models were tested for simulating experimental behavior characteristics of multicomponent adsorption such as the early breakthrough of certain substances and their appearance in the outlet stream in higher concentration than in the feed. With the equivalent solid film model of Gluckauf the experimentally observed behavior could be described very well. The characteristic parameters of this model were determined simply from single component breakthrough curves taken from short columns. The equilibrium model which assumes infinitely rapid adsorption kinetics was shown to be very useful since it provided an upper limit for the carbon capacity or a lower limit for the carbon dosage. An economic evaluation was used to determine optimum column design and layout for typical adsorption systems. Author

N78-24311# Princeton Univ., N. J. Dept. of Chemistry.
THE MOLYBDENUM-TO-MOLYBDENUM TRIPLE BOND. 5: PREPARATION AND STRUCTURE OF DIMETHYLTETRAKIS (DIMETHYLAMIDO) DIMOLYBDENUM
M. H. Chisholm, F. A. Cotton, M. W. Extine, and C. A. Murillo 8 Mar. 1978 22 p refs Prepared in cooperation with Texas A and M Univ., College Station
(Contract N00014-76-C-0826)
(AD-A051684; TR-78-09) Avail: NTIS HC A02/MF A01 CSCL 07/2

The existence of an extensive chemistry centering around the triplybonded Mo-Mo and W-W units is now well established and has recently been reviewed. A firm structural base for interpreting this chemistry has been provided by more than a score of X-ray crystallographic structure determinations. Among these, however, there have been only a few pairs of molybde-

num and tungsten compounds with the same or very similar sets of ligands. The comparisons afforded by such pairs are valuable in developing the comparative chemistry of the M-M multiple bonds in the 2d and 3d transition series. Author (GRA)

N78-24312# Boston Coll., Chestnut Hill, Mass. Dept. of Chemistry.
CHEMICAL KINETICS OF EXCITED STATES. NOVEL APPLICATION OF GAS PHASE EPR AND CHEMICAL KINETICS OF POLYATOMIC FREE RADICALS Annual Report for period ending 1977
David L. McFadden 25 Jan. 1978 19 p refs
(Contract N00014-75-C-0470)
(AD-A051720; AR-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

Chemical kinetics research at Boston College is now proceeding in two major areas. One area involves the direct study of the kinetics of gas phase chemical reactions of metastable electronically excited atoms and molecules. In contract year 1976 it was successfully demonstrated that Electron Paramagnetic Resonance (EPR) detection of metastable atoms in the gas phase can be combined with an electrical discharge-fast flow apparatus to obtain absolute rate constants for reactions of metastable atoms. GRA

N78-24313# Aerospace Corp., El Segundo, Calif. Vehicle Engineering Div.
ANALYTIC SOLUTIONS FOR CARBON SUBLIMATION IN ATMOSPHERES OF ELEMENTAL CARBON, HYDROGEN, NITROGEN, AND OXYGEN Final Report, 1 Aug. - 30 Sep. 1977
P. G. Crowell 1 Dec. 1977 55 p refs
(Contract F04701-77-C-0078)
(AD-A051699; TR-0078(3550-15)-2; SAMSO-TR-78-13) Avail: NTIS HC A04/MF A01 CSCL 11/2

Analytic solutions have been obtained for the equilibrium sublimation of a carbon surface in atmospheres whose elemental composition consists of carbon, hydrogen, oxygen, nitrogen, and an inert element. The solutions are expressed in simple algebraic expressions for the surface mass transfer parameter B prime and are computationally trivial, requiring only the evaluation of a quadratic equation. The analytic expressions are essentially exact and include an arbitrary number of carbon sublimation species and all the dominant gas phase reactions, while ignoring only those species which exist in trace amounts. The solutions are in excellent agreement with exact results from the ACE chemistry code. GRA

N78-24314# Kansas State Univ., Manhattan. Dept. of Physics.
INFRARED STUDIES OF WATER AND HYDRATED MATERIALS Final Report, 1967-1978
Dudley Williams 31 Mar. 1978 131 p refs
(Contract N00014-67-A-0403-0001)
(AD-A052267) Avail: NTIS HC A07/MF A01 CSCL 07/2

Several experimental methods for the quantitative determination of absorption band intensities in the infrared have been developed. These methods have been applied in a quantitative study of the infrared properties of water and aqueous solutions of strong electrolytes. Copies of the major journal articles reporting results of the study are included in this report. Author (GRA)

N78-24315# Massachusetts Inst. of Tech., Cambridge.
COMPUTER SIMULATION STUDIES OF MOLECULAR SOLIDS Final Report, 1 Jul. 1974 - 30 Nov. 1977
Sidney Yip 13 Feb. 1978 11 p refs
(Contract DAAG29-74-C-0036)
(AD-A052287; ARO-12157.8-P) Avail: NTIS HC A02/MF A01 CSCL 07/4

This report gives a summary of the problems studied, namely, thermodynamic properties and motions of grain boundaries, dynamics of molecular solids, and chemical reactions in model systems, and a brief description of the most significant results. Author (GRA)

N78-24316# Aeronautical Research Associates of Princeton, Inc., N. J.
PROPERTIES OF LARGE TURBULENT HYDROGEN/AIR DIFFUSION FLAMES, PART 1 Final Report, 9 May - 30 Sep. 1977
Harold S. Pergament and E. Stokes Fishburne Oct. 1977 44 p refs
(Contract F33657-77-C-0437)
(AD-A052781; ARAP-316-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 21/2

The prediction of IR radiation from large, turbulent H2/air diffusion flames requires a detailed analysis of flame properties, including the effects of buoyancy. This report gives the methodology employed for analyzing such flames and the results of calculations on large flames. These (and subsequent) results have been used as input to the IR radiation calculations on the C-1 stack discussed in Part 2 of this final report. The model discussed herein treats the axisymmetric turbulent mixing of coflowing streams, including nonequilibrium chemistry, employing an eddy viscosity formulation. Comparisons are made between model predictions and the nonbuoyant laboratory H2/air flame data. It is shown that centerline temperatures and species mole fractions can be predicted to good accuracy. However, the calculated rate of radial transport of energy and mass is greater than that measured in the laboratory experiments. The results of a series of parametric calculations on buoyant flames and comparisons with buoyant flame length data show that: flame properties scale with nondimensional distance for Froude numbers (Fr) greater than about 1,000,000, buoyancy significantly affects temperature decay rates downstream of the location of maximum temperature (after all the H2 has burned), and the predicted influence of Fr on buoyant flame lengths is consistent with the available data. GRA

N78-24317# Colorado State Univ., Fort Collins. Dept. of Chemistry.
ANALYTICAL IMPLICATIONS OF DIFFERENTIAL PULSE POLAROGRAPHY OF IRREVERSIBLE REACTIONS FROM DIGITAL SIMULATION CALCULATIONS AND EXPERIMENTS
James W. Dillard, John J. Odea, and R. A. Osteryoung Apr. 1978 34 p refs Submitted for publication
(Contract N00014-77-C-0004; Grant NSF CHE-75-00332)
(AD-A052836; TR-6) Avail: NTIS HC A03/MF A01 CSCL 07/4

Explicit finite difference simulations of differential pulse polarography have been developed for evaluating the analytical applications of differential pulse polarography to irreversible and quasireversible electron transfer reactions. From simulation data, detailed prediction of polarographic peak shape and position as a function of pulse height, pulse time and drop time is possible. Optimum conditions for analytical application of differential pulse polarography are discussed. Author (GRA)

N78-24318# Kentucky Univ., Lexington.
GAS ADSORPTION BY ACTIVATED AND IMPREGNATED CARBONS Quarterly Progress Report, Apr. - Jul. 1977
P. J. Reucroft and G. B. Freeman Oct. 1977 15 p refs
(Contract DAAA15-74-C-0163; DA Proj. 1W7-62710-A-095)
(AD-A052697; ARCSL-CR-77057; QPR-13) Avail: NTIS HC A02/MF A01 CSCL 07/2

HCN/H2O mixed vapor isotherms were measured on BPL activated and ASC whetlerite carbons maintaining an essentially constant relative water pressure and varying the relative HCN pressure. Chemisorption data on ASC whetlerite showed water vapor retention varying randomly between 0.001 gm/gm and 0.012 gm/gm and HCN/H2O retention decreasing from 0.050 gm/gm to 0.025 gm/gm with increasing HCN pressure. Author (GRA)

N78-24319# Kentucky Univ., Lexington.
GAS ADSORPTION BY ACTIVATED AND IMPREGNATED CARBONS Quarterly Progress Report, Jan. - Apr. 1977
P. J. Reucroft and G. B. Freeman Aberdeen Proving Ground, Md. ARRADCOM Jul. 1977 30 p refs
(Contract DAAA15-74-C-0163; DA Proj. 1W7-62710-A-095)
(AD-A052696; ARCSL-CR-77027; QPR-12) Avail: NTIS HC A03/MF A01 CSCL 07/2

Carbon tetrachloride isotherms were measured for Amoco GX-32, a pelletized form of carbon 2. K and W sub o values were comparable to other forms of carbon 2. Mixed isotherms

of H2O and HCN were measured showing the almost complete domination of the adsorption process by HCN, the solubility of HCN in the adsorbed phase of H2O, and the very low solubility of H2O in the adsorbed phase of HCN. Feasibility data were gathered for the examination of ultrapure carbons. Author (GRA)

N78-24320# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
AN ATOMIC FLUORESCENCE SYSTEM USING A CONTINUUM SOURCE FOR THE RAPID DETERMINATION OF WEAR METALS IN JET ENGINE LUBRICATING OILS M.S. Thesis - Fla. Univ.
Robert L. Vaughn Mar. 1978 65 p refs
(AD-A052721; AFIT-CI-78-53) Avail: NTIS HC A04/MF A01 CSCL 07/4

A brief review is presented of atomic absorption and atomic fluorescence methods of trace wear-metal analysis of jet engine lubricating oil. The theory of atomic fluorescence in flames is presented for the case of a continuum excitation source. A system for atomic fluorescence measurements is described that employs an electrically-heated graphite rod and a N2O/C2H2 flame atomizer with a 300-W Eimac xenon arc as the continuum excitation source. With this system, small samples (1 microliter) having complex matrices can be analyzed rapidly, conveniently, and with no pretreatment. Analytical calibration curves are given for Cr, Al, and Mo, and these metals are determined in synthetic and real jet engine lubricating oils. The determinations of these elements are evaluated with respect to the accuracy and repeatability criteria of the Interservice Oil Analysis Program.
Author (GRA)

N78-24321# Vermont Univ., Burlington. Dept. of Chemistry.
THERMAL REACTIONS OF THE MIXED-VALENCE IRON FLUORIDES, Fe2F5.nH2O
David B. Brown, Joseph A. Dilts, and Erick G. Walton 7 Apr. 1978 30 p refs Submitted for publication
(Contract N00014-75-C-0756; NR Proj. 356-593)
(AD-A052673; TR-8) Avail: NTIS HC A03/MF A01 CSCL 07/4

The thermal reactions of Fe2F5.7H2O and Fe2F5.2H2O have been studied using a combination of thermogravimetric, differential thermogravimetric, and differential thermal analysis and by differential scanning calorimetry. The initial dehydration of Fe2F5.7H2O near 100 C is shown to be a complex process which leads to a fluoride-deficient phase of nominal composition Fe2F5.2H2O. Further heating leads to a product at the hemihydrate level. Isothermal dehydrations lead to the previously reported phases A and B, but the formation of these materials is accompanied by both oxidation and fluoride loss. Vacuum dehydration of F2eF5.7H2O leads to a fully mixed-valence monohydrate phase, A: which was previously prepared by dehydration in an HF atmosphere. Dehydration of the authentic, crystalline, Fe2F5.2H2O is seen to be distinguishable from the second stage dehydration of Fe2F5.7H2O. Both the thermogravimetric analyses and the kinetic parameters extracted from the several thermal techniques demonstrate that these two forms of 'Fe2F5.2H2O' differ significantly in their thermal reactions.
Author (GRA)

N78-24322# Oak Ridge Y-12 Plant, Tenn.
DETERMINATION OF PERCENT NITROGEN IN SILICON NITRIDE
L. D. Keele Sep. 1977 15 p refs
(Contract W-7405-eng-26)
(Y-2085) Avail: NTIS HC A02/MF A01

Percent nitrogen in samples of silicon nitride could be determined by an analytical procedure that first used a pyrydrolysis setup to produce an ammonia-type nitrogen solution. Next, the solution was condensed and trapped in a one-molar sulfuric acid solution which was then transferred to a modified Kjeldahl apparatus. Finally, the distillate was trapped in a boric acid solution and titrated, using a mixed indicator. In 12 determinations on a commercial grade of silicon nitride, the nitrogen content was found to be 38.13 plus or minus 0.84 wt%. ERA

N78-24323# Argonne National Lab., Ill.
PRESSURE INDUCED STRAIN TRANSITION IN NiF2
J. D. Jorgensen, T. G. Worlton (Chicago Univ.), and J. C. Jamieson 1977 18 p refs Presented at the Sixth Intern. High Pressure Conf., Boulder, Colo., 25-29 Jul. 1977
(Contract W-31-109-eng-38)
(CONF-770706-27) Avail: NTIS HC A02/MF A01

Time-of-flight neutron powder diffraction measurements give the first evidence that NiF2 undergoes a pressure induced, continuous strain transition from a tetragonal to an orthorhombic structure. Lattice, structural and thermal parameters were determined at pressures to 3.24 GPa. Even though the orthorhombic strain was sufficiently small that doublets were not resolved, the use of profile refinement of the diffraction spectra enabled an accurate determination of the lattice parameters near the transition. The measured atomic positions and anisotropic thermal displacements show that motion of the F atoms is responsible for the transition. ERA

N78-24324# Energy Research and Development Administration, Bartlesville, Okla.
GLC ANALYSIS OF N-PARAFFIN DISTRIBUTIONS IN CRUDE OILS AND TOPPED CRUDE OILS FOR OIL IDENTIFICATION
P. L. Grizzle and H. J. Coleman Oct. 1977 25 p refs
(BERC/RI-77/12) Avail: NTIS HC A02/MF A01

Weight-percent distributions of normal paraffins obtained from gas-liquid chromatographic analyses were evaluated for their importance in oil identification. By use of statistical analysis, the weight percents for the C11 through C35 n-paraffins were determined to be significant variables for the differentiation of unweathered crude oil samples. Similarly, the ratios of pristane to n-heptadecane, phytane to n-octadecane, and phytane to pristane were determined to be important. By use of weight-percent distributions, two numerical methods were evaluated for reducing the variations in the analytical data between weathered crude oil samples and corresponding unweathered crude oils, resulting from environmental weathering. ERA

N78-24325# Energy Resources Co., Inc., Cambridge, Mass.
STUDY TO DETERMINE THE TECHNICAL AND ECONOMIC FEASIBILITY OF RECLAIMING CHEMICALS USED IN MICELLAR POLYMER AND LOW TENSION SURFACTANT FLOODING Progress Report, 24 Apr. - 20 May 1977
Vaqar Zakaria May 1977 7 p
(Contract EF-77-C-01-2600)
(FE-2600-1) Avail: NTIS HC A02/MF A01

Laboratory procedures for formation and analysis of emulsions were developed, and pilot units for evaluation of recovery techniques were test run. A state-of-the-art review of oil/water separation technologies is well on the way. ERA

N78-24326# Energy Resources Co., Inc., Cambridge, Mass.
STUDY TO DETERMINE THE TECHNICAL AND ECONOMIC FEASIBILITY OF RECLAIMING CHEMICALS USED IN MICELLAR POLYMER AND LOW TENSION SURFACTANT FLOODING Progress Report, 20 May - 17 Jun. 1977
Richard H. Stephens Jun. 1977 7 p
(Contract EF-77-C-01-2600)
(FE-2600-2) Avail: NTIS HC A02/MF A01

The literature search to review and evaluate the state-of-the-art oil/water separation was completed except for obtaining vendor information on specific oil field equipment. Preliminary ultrafiltration runs of oil-water-surfactant mixtures and reverse osmosis of surfactant/water solutions were made to evaluate the testing procedure and the analytical techniques. ERA

N78-24327# Hanford Engineering Development Lab., Richland, Wash.
SELECTION OF PROCESS PARAMETERS FOR SODIUM REMOVAL VIA THE WATER VAPOR NITROGEN PROCESS
Monte Crippen Oct. 1977 39 p refs
(Contract EY-76-C-14-2170)
(HEDL-TME-77-62) Avail: NTIS HC A03/MF A01

The water vapor nitrogen (WVN) process for removing sodium from stainless steel equipment, with emphasis on the basis for selecting final operating parameters is reviewed. The process includes vapor treatment with 5% water at 160 F to 190 F, hot water rinsing, and hot gas drying. ERA

N78-24328# Sandia Labs., Albuquerque, N. Mex.
LARGE SCALE SODIUM TEST FACILITY
D. L. King, J. E. Smaardyk, H. J. Sutherland, and R. A. Sallach 1977 8 p Presented at the Post Accident Heat Removal Inform. Exchange Meeting, Chicago, 2 Nov. 1977
(Contract EY-76-C-04-0789)
(SAND-77-1421C; Conf-771108-4) Avail: NTIS HC A02/MF A01

The large scale sodium test facility in use at Sandia Laboratories was designed to be used for a wide range of sodium interaction experiments. Of initial concern is the interaction of hot sodium with concrete under conditions similar to accident conditions in any sodium cooled reactor. The tests to be run cover the cases of sodium spills and sprays on bare concrete and on cells with defective steel liners. The initial series of tests in progress at the facility involves rapidly dropping from 20 kg to 225 kg of sodium at temperatures from 550 C to 850 C into concrete crucibles that are representative of the concrete to be used at the Clinch River Breeder Reactor Plant. Specific objectives are to obtain sufficient information to completely describe the sodium/concrete interaction including: reaction rate, heat of reaction, gas evolution and flow, movement of the reaction front, reaction product formation, and the effects of variation of drop temperature and reaction area geometries. ERA

N78-24329# Addis Translations International, Portola Valley, Calif.
COMPLEXOMETRIC DETERMINATION OF EPOXIDE GROUPS
E. N. Zelenina Sep. 1977 5 p refs Transl. into ENGLISH from the book "Atom-no-Absorptsionnyi Analiz Promyshlennykh Materialov i Syrra" Moscow, 1976 p 189-191 Prepared for California Univ., Lawrence Livermore Lab. Sponsored by DoE (UCRL-Trans-11281) Avail: NTIS HC A02/MF A01

The thiosulfate-magnesium sulfate method was modified to give a fast, accurate complexometric method. The epoxide sample was dissolved in ethanol, sodium thiosulfate and magnesium sulfate solutions added; the solution was refluxed and filtered. A portion of the filtrate was treated with ammonia buffer and chrome black special ET 00 indicator, and titrated with Trilon B until the wine red color becomes blue. The error is + -0.5 rel percent when the epoxide content is greater than or equal to 1 percent, + -2.5 rel percent when the content is below 1 percent. ERA

N78-24330# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
STUDY ON THE ELECTROCHEMICAL BEHAVIOR OF III-V SEMICONDUCTORS Final Report [ETUDE DU COMPORTEMENT ELECTROCHIMIQUE DES COMPOSES III-V ET APPLICATIONS]
L. Hollan and J. C. Tranchart May 1977 74 p refs In FRENCH
(Contract DGRST-75-7-0823-PE)
(LEP-77/486.SME-637-B) Avail: NTIS HC A04/MF A01

Electrochemical behavior was studied with a view to implementing component manufacturing technologies. In addition to classical methods of plotting I(V) characteristics, C(V) measurements were made to determine the flat band potentials of various III-V components. Thus, electrochemical properties of various III-V semiconductors, n and p type, in the dark and under illumination, in baths of different pH, were established. Selective anodic GaAs n/p and p/n dissolution conditions were also established. The anodic oxidation of GaAs has made possible the study of the oxide/GaAs interface and has been used as a means for characterization and selective thinning. ESA

N78-24331# National Technical Information Service, Springfield, Va.
ELECTRODEPOSITION, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Mar. 1976 - Mar. 1978
William E. Reed Mar. 1978 140 p Supersedes NTIS/PS-77/0286; NTIS/PS-76/0307; NTIS/PS-75/331
(NTIS/PS-78/0301; NTIS/PS-77/0286; NTIS/PS-76/0307; NTIS/PS-75/331) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 07D

The technology of electrodeposition and electroforming is presented. Topics include applications, safety, processes, operations, coatings, films, and platings. GRA

N78-24332# Bureau of Mines, Pittsburgh, Pa.
THE DIFFUSION FLAME IN FREE CONVECTION. BUOYANCY-INDUCED FLOWS, OSCILLATIONS, RADIATIVE BALANCE, AND LARGE-SCALE LIMITING RATES
M. Hertzberg, K. Cashdollar, C. Litton, and D. Burgess 1978 39 p refs
(PB-277250; BM-RI-8263) Avail: NTIS HC A03/MF A01 CSCL 20B

The cross-coupling between buoyancy-induced flows and the combustion process was explored as it related to the size, structure, and radiative balance of flames. A critique of classical diffusion flame studies is first presented. The buoyancy force-couple was then introduced and an equation was derived for the maximum free convective velocity of an expanding combustion wave. New data are presented for the size-dependent radiance oscillations of diffusion flames. Data are also presented for the angular distribution of the total radiant intensity from a small methanol pool flame. Both the amplitude and frequency of the measured oscillations were compared with theoretical predictions that were based on a new view of the structure of diffusion flames. This new view was at variance with the traditional one which assumed uniform reaction in the diffusive mixing zone. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N78-24333* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHOD OF PRODUCING COMPLEX ALUMINUM ALLOY PARTS OF HIGH TEMPER, AND PRODUCTS THEREOF Patent
Irvin J. Wilson, inventor (to NASA) (Rockwell International Corp., Downey, Calif.) Issued 7 Mar. 1978 4 p Filed 26 Jul. 1976 Supersedes N76-29401 (14 - 20 p 2579) Sponsored by NASA
(NASA-Case-MSC-19693-1; US-Patent-4,077,813; US-Patent-Appl-SN-708771; US-Patent-Class-148-12.7A; US-Patent-Class-148-125) Avail: US Patent Office CSCL 11F

Fully annealed aluminum sheet is first stretch formed to the complex, doubly compound shape of a previously prepared forming die, e.g., an ejection seat blowout panel of a shuttlecraft. The part is then marked with a series of grid lines for monitoring later elongation. Thereafter it is solution heat treated and refrigerated to retard hardening. While still soft, it is stretched a second time on the same die to induce a modicum of work hardening, after which it is aged to the desired stress corrosion resistant temper, preferably the T8 level, to provide the desired hardness and stress corrosion resistance.
Official Gazette of the U.S. Patent Office

N78-24334 South African Bureau of Standards, Pretoria.
STANDARD SPECIFICATION FOR HOT-DIP (GALVANIZED) ZINC COATINGS (OTHER THAN ON CONTINUOUSLY ZINC-COATED SHEET AND WIRE)
Nov. 1977 82 p In ENGLISH and AFRIKAANS Revised
(SABS-763-1977; ISBN-0-626-04476-6) Copyright. Avail: Issuing Activity

Zinc coatings are discussed that are applied by a hot dip method to components of structural steelwook, weldments, pressings, tubes (pipes), threaded articles, forgings, and castings, and to hollow-ware, cisterns, cylinders, and tanks that are hot-dip zinc coated after fabrication. Certain aspects of the hot-dip zinc coating process are also elaborated. Author

N78-24335*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NEW ALLOYS TO CONSERVE CRITICAL ELEMENTS
Joseph R. Stephens 1978 15 p refs Presented at the Intern. Eng. Conf. and Tool Exposition, Philadelphia, 8-11 May 1978;

sponsored by the Soc. of Manufacturing Engr.
(NASA-TM-78840; E-9551) Avail: NTIS HC A02/MF A01 CSCL 11F

Based on availability of domestic reserves, chromium is one of the most critical elements within the U.S. metal industry. New alloys having reduced chromium contents which offer potential as substitutes for higher chromium containing alloys currently in use are being investigated. This paper focuses primarily on modified Type 304 stainless steels having one-third less chromium, but maintaining comparable oxidation and corrosion properties to that of type 304 stainless steel, the largest single use of chromium. Substitutes for chromium in these modified Type 304 stainless steel alloys include silicon and aluminum plus molybdenum. Author

N78-24336*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CYCLIC OXIDATION OF COATED OXIDE DISPERSION STRENGTHENED (ODS) ALLOYS IN HIGH VELOCITY GAS STREAMS AT 1100 DEG C
Michael A. Gedwill May 1978 20 p refs
(NASA-TM-78877; E-9611) Avail: NTIS HC A02/MF A01 CSCL 11F

Several overlay coatings on ODS NiCrAl's were tested in Mach 1 and Mach 0.3 burner rigs to examine oxidation and thermal fatigue performance. The coatings were applied by various methods. Based on weight change, macroscopic, and metallographic observations in Mach 1 tests Nascoat 70 on TD-NiCrAl exhibited the best oxidation resistance. In Mach 0.3 tests PWA 267 and ATD-1, about equally, were the best coatings on YD-NiCrAl (Nascoat 70 was not tested in Mach 0.3 rigs). Author

N78-24337# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
PHOTOEMISSION STUDIES ON LIQUID METALS Ph.D. Thesis [UNTERSUCHUNGEN DER PHOTOEMISSION AN FLUESSIGEN METALLEN]
Peter Oelhafen 1976 71 p refs In GERMAN; ENGLISH summary
(Diss-5767) Avail: NTIS HC A04/MF A01

The system Hg(l-x)In(x) (zero< or = to x< or = to 1) was examined. The addition of indium causes the disappearance of the pseudo-gap in the density of states of liquid mercury with increasing amount of indium. The influence of the angle of polarization of the incident light on the quantum yield proved that the volume effect was the dominant excitation process in photoemission on liquid mercury. The angular distribution of the photoelectrons from liquid mercury could be explained if the quantum mechanical reflection of the electrons at the surface potential step was taken into account. Author

N78-24338# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
LORENTZ NUMBER AND THERMAL CONDUCTANCE IN LIQUID METALS Ph.D. Thesis [LORENZZAHL UND THERMISCHE LEITFAHIGKEIT FLUSSIGER METALLE]
Walter Haller 1976 41 p refs In GERMAN; ENGLISH summary
(Diss-5841) Avail: NTIS HC A03/MF A01

An apparatus was developed to measure directly the Lorenz number of liquid metals up to 500 C. The Kohlrausch method was applied to a constriction shaped spherical sample. The drastic influence of the convection on the measurements of the Lorenz number required the use of very small temperature differences less than 0.15 C. Therefore a temperature stability of 0,0001 C was necessary. Measurements on liquid tin are reported. Author

N78-24339# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
A GENERALIZATION OF THE APPARENT CREEP ACTIVATION ENERGY CONCEPT USING SEMI-EMPIRICAL STATEMENTS AND THEIR APPLICATION TO THE CREEP BEHAVIOR OF ROUGH TWO-PHASE SINTERING COPPER-TUNGSTEN ALLOY WITH 50 VOLUME PERCENT TUNGSTEN Ph.D. Thesis [EINE VERALLGEMEINERUNG DES BEGRIFFS DER SCHEINBAREN AKTIVIERUNGSENERGIE FUER KRIECHEN IN HALBEMPIRISCHEN ANSATZEN UND DEREN ANWENDUNG AUF DAS KRIECHVERHALTEN DER GROB-ZWEIPHASIGEN SINTERLEGIERUNG CU-W MIT 50V/O W]
Hans Joerg Martens [1977] 122 p refs In GERMAN; ENGLISH summary
(Diss-6069) Avail: NTIS HC A06/MF A01

The apparent activation energy for steady-state creep, Q in semi-empirical relationships is generally accepted to lie near the activation energy for bulk diffusion or grain boundary diffusion respectively, Q sub d. In some cases, however, this is not the case. The Q values as high as 1300 kJ/mole were reported, exceeding Q sub d by factors of up to 3 and more. In such cases, Q is not equal to Q sub d, although Q sub d, used in the Zener-Hollomon-Parameter unifies successfully the creep curves from different creep rates. Therefore, the Arrhenius term Q sub d was generalized, becoming a lump creep activation energy, which has to be analyzed later on by physical models. Author

N78-24340# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.
DEFORMATION AND FRACTURE OF CONTROLLED EUTECTICS CONTAINING INTERMETALLIC COMPOUNDS Final Technical Report, 1969 - Dec. 1977
N. S. Stoloff 15 Feb. 1978 11 p
(Contract N00014-75-C-0503)
(AD-A051721) Avail: NTIS HC A02/MF A01 CSCL 11/6

The results of research performed under this contract on the following aligned eutectics are summarized: Ag3Mg-AgMg. Al-Ag2Al, Al-Al3Ni, Ni, Cr, Al-TaC (Nitac) and Ni, Nb, Cr, Al. Tensile, fatigue and creep experiments have shown the importance of refining interphase spacing in producing increased strength. GRA

N78-24341# Kansas State Univ., Manhattan. Dept. of Chemical Engineering.
INTERFACIAL ENERGIES OF SOME ELEMENTAL AND ALLOY AEROSPACE MATERIALS Final Report, 30 Jun. 1975 - 31 Dec. 1977
Thomas A. Roth 20 Jan. 1978 39 p refs
(Grant AF-AFOSR-2868-75; AF Proj. 2306)
(AD-A051181; AFOSR-78-0350TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

Previously unreported values of the grain boundary free energies for pure titanium and the titanium alloy Ti-6Al-4V and of the surface free energy for the titanium alloy, as well as a new value of the surface free energy for pure titanium, have been determined using the zero-creep technique for small diameter wires and measurements of the dihedral angle at the base of thermally-etched grain boundary grooves. The temperature coefficients of the surface free energies and of the grain boundary free energies, as well as the self-diffusion coefficients, for pure titanium and for the Ti-6Al-4V alloy are reported. GRA

N78-24342# Rocketdyne, Canoga Park, Calif.
THE EFFECT OF HYDRAZINE DECOMPOSITION PRODUCTS ON THE MECHANICAL PROPERTIES OF HIGH-TEMPERATURE ALLOYS Final Report, 1 Mar. 1976 - 1 Apr. 1977
W. T. Chandler 15 Mar. 1978 63 p refs
(Contract F33615-76-C-5201; AF Proj. 7312)
(AD-A052288; RI/RD77-143; AFML-TR-77-95) Avail: NTIS HC A04/MF A01 CSCL 11/6

An experimental and analytical program was conducted to develop data for the screening and selection of alloys for use in APU system gas generator and turbine components, where such components are exposed to environmental effects of hydrazine decomposition products. Alloys selected for investigation were Haynes 188 and Inconel 600 as candidates for the gas generator, and Rene: 41 and IN-100 as candidates for turbine components. Tension tests and compressive low-cycle fatigue tests were performed on hollow specimens pressurized internally with 700-psi NH3/N2/H2 gas mixtures simulating APU hydrazine decomposition products and with argon for comparison. GRA

N78-24343# Lockheed Missiles and Space Co., Palo Alto, Calif.
A FUNDAMENTAL STUDY OF FLOW AND FRACTURE IN BERYLLIUM Interim Technical Report, 1 Jun. 1976 - 31 Dec. 1977

Donald Webster and Donald D. Crooks Jan. 1978 38 p refs
(Contract DAAG29-76-C-0051)
(AD-A052824; LMSC-D566852; ARO-13387.1-MS) Avail: NTIS HC A03/MF A01 CSCL 11/6

The effect of thermomechanical treatments on the grain size of HIP beryllium powder block and cast beryllium alloys has been studied. A grain size controlled fracture mode change has been observed in both powder source and ingot source beryllium. The mechanism of recrystallization in beryllium has been observed to be the in situ transformation of subgrains to grains by dislocation migration from grain interiors to grain boundaries. Maximum impact resistance was observed in partly recrystallized structures rather than the expected fully recrystallized state. Author (GRA)

N78-24344# Aluminum Co. of America, Alcoa Center, Pa.
EXPLORATORY DEVELOPMENT FOR DESIGN DATA ON STRUCTURAL ALUMINUM ALLOYS IN REPRESENTATIVE AIRCRAFT ENVIRONMENTS Final Report, 1 May 1974 - 30 Apr. 1977
D. J. Brownhill, R. E. Davies, G. E. Nordmark, and B. M. Ponchel Jul. 1977 197 p refs
(Contract F33615-74-C-5089; AF Proj. 7381)
(AD-A052809; AFML-TR-77-102) Avail: NTIS HC A09/MF A01 CSCL 11/6

The mechanical properties, fracture toughness, fatigue, fatigue-crack growth rates in three environments and corrosion characteristics of 10 lots each of 2048-T851, 7050-T7351 and 7475-T7351 plate and 2219-T852 hand forgings have been evaluated. Data for establishing MIL-HDBK-5 values, including modulus of elasticity and stress-strain are presented. GRA

N78-24345# Stanford Univ., Calif. Div. of Applied Mechanics.
STRAIN RATE INFLUENCES ON SHOCK WAVE PROPAGATION IN METALS Final Report
E. H. Lee Nov. 1977 44 p refs
(Contract DAAG46-74-C-0057)
(AD-A052816; SUDAM-77-3; AMMRC-CTR-77-28) Avail: NTIS HC A03/MF A01 CSCL 11/6

The theory of the propagation of shock waves, and steady waves having an invariant profile, is considered. The wave structures associated with rate independent plasticity laws are contrasted with those influenced by rate effects. Thermo-elastic plastic response is considered, and the laws are formulated so the hydrodynamic theory supplies a component of the solution when shear strength effects are significant. When rate effects are included a marked difference in the response of work-hardening and strain-hardening materials is evident. Some comments are made on the influence of material inhomogeneity. Author (GRA)

N78-24346# Oregon Graduate Center for Study and Research, Beaverton.
MECHANISM OF ENHANCED TOUGHNESS IN MARTENSITIC ALLOYS Final Report, 1 Oct. 1976 - 30 Sep. 1977
W. E. Wood 14 Feb. 1978 149 p refs
(Contract N00019-77-C-0135)
(AD-A052536) Avail: NTIS HC A07/MF A01 CSCL 11/6

The objective of this program was to establish the role of heat treatment parameters on the fracture toughness of ultrahigh strength steels. Microstructural examination, plane strain fracture toughness, Charpy and tensile tests were conducted on alloys 4340 and silicon modified 4340. Heat treatments included both direct as well as step quench schedules. Austenitizing temperatures ranged from 870 C to 1200 C, and step quenching temperatures ranged from 250 C to 100 C. GRA

N78-24347# Washington State Univ., Pullman.
EXPERIMENTAL INVESTIGATION OF THE KINETICS OF THE SHOCK-INDUCED ALPHA TO EPSILON PHASE TRANSFORMATION IN ARMCO IRON
Jerry W. Forbes 15 Dec. 1977 155 p refs
(Contract F44620-67-C-0087; Grant AF-AFOSR-1088-66)
(AD-A052689; NSWC/WOL/TR-77-137) Avail: NTIS HC A08/MF A01 CSCL 11/6

Under the influence of shock waves certain materials undergo polymorphic transformations. The time available in a shock experiment for such a transformation to occur does not exceed a few microseconds, yet the same transformation may require minutes or hours for completion in a static experiment. This large transformation rate is an important distinctive feature of transformations in shock waves. Little is known about atomic mechanisms which cause these ultrafast transformations. This void in knowledge is partly due to lack of experimental data. The need for data and understanding of the transformation process is the reason for this work. GRA

N78-24348# Army Materials and Mechanics Research Center, Watertown, Mass.
TRIP STEELS PROMISE HIGH RELIABILITY HARDWARE Final Report
Kenneth H. Abbott Feb. 1978 18 p
(AD-A052765; AMMRC-MS-78-2) Avail: NTIS HC A02/MF A01 CSCL 11/6

Based on a review of the properties of typical TRIP steels, a discussion is presented of possible Army applications for this new material. Problems related to component fabrication and specification controls are presented, and a brief outline of a recommended R and D program is included. Author (GRA)

N78-24349# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
LOCALIZED HYDROGEN ANALYSIS IN SIMULATED GRAIN BOUNDARIES OF ALUMINUM ALLOYS EXPOSED TO STRESS CORROSION Final Report, 28 Apr. 1975 - 28 Sep. 1976
Philip N. Adler Feb. 1978 54 p refs
(Contract N00019-75-C-0394)
(AD-A052723; RE-551) Avail: NTIS HC A04/MF A01 CSCL 11/6

The role of hydrogen in the stress corrosion attack of 7000 series aluminum alloys was investigated using sputtered film/substrate samples to simulate the grain boundary constituents in these alloys. Localized hydrogen measurements were made in the film, interface region, and substrate using the Lithium Nuclear Microprobe for Hydrogen (LNMH) technique. Hydrogen concentrations were measured in samples of pure aluminum film/7075 substrate, 7475 film/7075 substrate, and MgZn2 film/7075 substrate for as-sputtered, corrosion exposed, and stress corrosion exposed conditions as well as after stress removal. A substantial hydrogen concentration increase was observed in the interface region of MgZn2 film/7075 substrate samples exposed to stress corrosion; smaller increases were introduced in the interface region of 7475 film/7075 substrate samples; no increase occurred in aluminum film/7075 substrate samples. GRA

N78-24350# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
MICROSTRUCTURAL EFFECTS AND FATIGUE LIFE PREDICTIONS OF NOTCHED AND UN-NOTCHED NICKEL BASE SUPERALLOYS AT ELEVATED TEMPERATURES Interim Report, 1 Jan. - 31 Dec. 1977
Stephen D. Antolovich Feb. 1978 39 p refs
(Grant AF-AFOSR-2952-76)
(AD-A052586; AFOSR-78-0536TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

The low cycle fatigue (LCF) of Rene 80 has been investigated at 1400, 1600 and 1800 F. Emphasis has been placed on the 1800 F studies using smooth bar (continuous cycling and 90 sec hold time) and notch LCF specimens. The detailed transmission electron microscopy shows that at 1600 and 1800 F the dislocation debris is independent of test rate over two orders of magnitude. The test results can not be explained in terms of the conventional approaches to high temperature LCF for which damage is assumed to result from creep/fatigue interactions. Instead, it is suggested that the important damage mechanism is an interaction between the deformation mode and the environment. Based on that understanding a model is developed for crack propagation at elevated temperatures and a similar model is being developed for crack initiation. Author (GRA)

N78-24351# Army Materials and Mechanics Research Center, Watertown, Mass. Process Development Div.
HOMOGENIZATION OF CRITICAL STEEL CASTINGS Final Report

Arthur M. Ayvazian Jan. 1978 25 p
(DA Proj. 6737104)
(AD-A052344; AMMRC-TR-78-1) Avail: NTIS HC A02/MF A01 CSCL 11/6

Four different types of castings, the composition of which ranged from low alloy to medium alloy steels, were homogenized at temperatures of 2400 F for periods of 32 and 64 hours. After the austenitizing and tempering treatments substantial increases were observed in the ductility and toughness properties. These results indicated that the degree of property improvement was related to the steel composition, the structural condition of the castings prior to homogenization, subsequent heat treatments after homogenization, and required mechanical properties. Author (GRA)

N78-24352# Oak Ridge National Lab., Tenn.
CREEP-RUPTURE PROPERTIES OF DECARBURIZED AND AGED 2 1/4 Cr-1 Mo STEEL
R. L. Klueh Aug. 1977 24 p refs
(Contract W-7405-eng-26)
(ORNL-5292) Avail: NTIS HC A02/MF A01

Creep rupture studies were made on 2 1/4 Cr-1 Mo steel that had been decarburized in sodium or thermally aged in an inert atmosphere for 26,500 hr at 566 C. Tests were made on the decarburized specimens at 510 and 566 C and on the thermally aged specimens at 566 C. The creep-rupture properties for both conditions were below the average properties for annealed 2 1/4 Cr-1 Mo steel (the steel is annealed by slowly cooling from the austenitizing temperature to give a microstructure that that is primarily proeutectoid ferrite). The difference was greatest for short rupture times. At long rupture times the creep rupture properties for the aged and decarburized steels approached the minimum for annealed steel. This approach of properties could be explained by changes in microstructures that occur in 2 1/4 Cr-1 Mo steel during elevated-temperature exposure. The properties of the decarburized steel were somewhat below those for the thermally aged steel. ERA

N78-24353# Open Univ., Milton (England). Energy Research Group.
COPPER AND ALUMINIUM: A DATA BASE FOR A PHYSICAL INPUT/OUTPUT STUDY
Rosalind Armson Jan. 1978 35 p refs
Avail: NTIS HC A03/MF A01; Secr., Energy Research Group, Walton Hall, Milton Keyes, Engl.

The data base presented is part of the data assembled for a project concerned with investigating the effects of technical change upon the industrial system of the U. K. The model used is an input-output table in which the commodity flows in the industrial system are traced in terms of physical quantities rather than, monetary terms, as is more conventional. A technique in which two transaction matrices, a make matrix and a technology matrix, are combined with a vector of final demand using a vector of activity levels was developed. The model was applied to copper and aluminum. Author (ESA)

N78-24354# Bureau of Mines, Washington, D. C.
VANADIUM, 1977
Grace N. Broderick 1977 18 p refs Revised
(PB-277639; BM-MCP-8-Rev) Avail: NTIS HC A02/MF A01 CSCL 11F

A comprehensive description and analysis of the vanadium industry is given. Included is information on industry structure, size and organization; definitions, grades, and specifications; reserves and resources; geology; production and capacity; uses; technology; byproducts and coproducts; strategic considerations; economic and operating factors and problems; supply-demand relationships; and forecasts of supply and demand. Vanadium is used principally as an alloy in steel. Other important uses are in titanium alloys and in various chemical catalytic processes. The world supply of vanadium is sufficient to last far beyond the year 2000 at the present and projected rates of consumption. Almost all of the resources will economically yield vanadium only in conjunction with a coproduct. Author

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N78-24355 South African Bureau of Standards, Pretoria
STANDARD SPECIFICATION FOR GLASS FIBRE REINFORCING MATERIAL FOR PIPE WRAPPING
8 Mar. 1978 28 p In ENGLISH and AFRIKAANS
(SABS-1130-1978; ISBN-0-626-04532-0) Copyright. Avail: Issuing Activity

This specification covers the following three types of reinforcing material constructed from glass fibre and suitable for embedding in a bitumen or coal far enamel protective coating on pipes: (1) a random glass fibre mat of relatively low tensile strength intended primarily for use as an inner wrap, (2) a woven glass fibre scrim, coated with bitumen or coal tar enamel, of high tensile strength in both longitudinal and transverse directions, with relatively low binder-holdering capacity, and intended primarily for use in the outer layers of the bitumen or coal tar enamel coating; and (3) a woven or bonded glass fibre scrim combined with random glass fibre mat to achieve a tensile strength in both directions and intended for use in the inner or the outer layers of the bitumen or coal tar enamel coating. Author

N78-24356 South African Bureau of Standards, Pretoria.
STANDARD SPECIFICATION FOR RUBBER HOSE FOR LIQUEFIED PETROLEUM GAS (LPG). PART 2: HOSE AND TUBING FOR USE IN LPG VAPOUR PHASE AND LPG-AIR INSTALLATIONS
8 Mar. 1978 42 p In ENGLISH and AFRIKAANS
(SABS-1156-1978-Pt-2; ISBN-0-626-04533-9) Copyright. Avail: Issuing Activity

Specifications are given for flexible rubber tubing and hose for use, at a temperature not exceeding 60 C, in LPG vapor phase and LPG-air installations. Specifications given include inside and outside diamters, strength and stretch, resistance to pneumatic pressure, resistance to bursting, and flame resistance. Methods of testing tubing and hoses are described. P.R.A.

N78-24357*# Battelle Columbus Labs., Ohio.
ANALYSIS AND ASSESSMENT OF FILM MATERIALS AND ASSOCIATED MANUFACTURING PROCESSES FOR A SOLAR SAIL Summary Report
E. J. Bradbury, R. J. Jakobsen, and F. A. Sliemers 23 Feb. 1978 18 p
(Contract JPL-954659)
(NASA-CR-157054) Avail: NTIS HC A02/MF A01 CSCL 07D

Candidate resin manufacturers and film producers were surveyed to determine the availability of key materials and to establish the capabilities of fabricators to prepare ultrathin films of these materials within the capacity/cost/time constraints of the Halley program. Infrared spectra of three candidate samples were obtained by pressing each sample against an internal reflection crystal with the polymer sandwiched between the crystal and the metal backing. The sample size was such that less than one-fourth of the surface of the crystal was covered with the sample. This resulted in weak spectra requiring a six-fold expansion. Internal reflection spectra of the three samples were obtained using both a KRS-5 and a Ge internal reflection crystal. Subtracted infrared spectra of the three samples are presented. Author

N78-24358*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ION BEAM SPUTTER ETCHING AND DEPOSITION OF FLUOROPOLYMERS
Bruce A. Banks, James S. Sovey, Thomas B. Miller, and Karen S. Crandall 1978 17 p refs Presented at the 8th Intern. Conf. on Electron and Ion Beam Sci. and Tech., Seattle, 21-26 May 1978; sponsored by the Electrochemical Soc., Inc.
(NASA-TM-78888) Avail: NTIS HC A02/MF A01 CSCL 07D

Fluoropolymer etching and deposition techniques including thermal evaporation, RF sputtering, plasma polymerization, and ion beam sputtering are reviewed. Etching and deposition

mechanism and material characteristics are discussed. Ion beam sputter etch rates for polytetrafluoroethylene (PTFE) were determined as a function of ion energy, current density and ion beam power density. Peel strengths were measured for epoxy bonds to various ion beam sputtered fluoropolymers. Coefficients of static and dynamic friction were measured for fluoropolymers deposited from ion bombarded PTFE. Author

N78-24359# Polish Academy of Sciences, Warsaw.
THE THEORY OF CRYSTAL NUCLEATION IN POLYMERS
Andrzej Ziabicki 29 Oct. 1977 38 p refs
(Grant NSF INT-76-17522)
Avail: NTIS HC A03/MF A01

The manner in which morphological features of polymer crystallization affect the form of nucleation equations and the resulting nucleation rates and critical transformation conditions is examined. A morphological matrix is given for folded-chain, bundlelike, and isolated-rod nucleation. The analysis of superposed mechanisms including both kinetical factors and thermodynamical factors provides a first step towards independent prediction of the resulting morphology from elementary information about isolated mechanisms. Of particular importance in the application of this theory to specific systems is the problem of time-lag functions, and the related effectivity coefficients. Author

N78-24360*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CRYSTALLINE POLYIMIDES Patent Application
Terry L. StClair and Anne K. StClair, inventors (to NASA) Filed 16 May 1978 8 p
(NASA-Case-LAR-12099-1; US-Patent-Appl-SN-906299) Avail: NTIS HC A02/MF A01 CSCL 07C

Aromatic crystalline polimides were disclosed that were synthesized from polyamide-acid and when heated to 200 to 300 C became cyclized to afford an opaque polymer which by X-ray diffraction of the unoriented film exhibited 47 percent crystallinity. Differential scanning calorimetry indicated a melt at 425 C with no glass transition in these crystalline polyimides.
NASA

N78-24361# Pennwalt Corp., King of Prussia, Pa. Central Research and Development Dept.
THE APPLICATION OF A DIPOLAR THEORY TO THE PIEZOELECTRICITY IN VINYLIDENE FLUORIDE-CO-TETRAFLUOROETHYLENE POLYMERS
Harry Stefanou Mar. 1978 26 p refs
(Contract N00014-77-C-0130)
(AD-A051753; TR-1) Avail: NTIS HC A03/MF A01 CSCL 11/9

The distributions of statistics employed in classifying the source of a new observation, using observed distances which are subjected to measurement errors, are discussed. A useful approximate expansion is obtained. A new method of estimating the parameter of a noncentral chi-square distribution is derived.
GRA

N78-24362# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
VISCOELASTIC PROPERTIES OF HOMOPOLYMERS AND DIBLOCIC COPOLYMERS OF POLYBUTADIENE AND POLYISOPRENE
R. E. Cohen and A. R. Ramos 27 Mar. 1978 37 p refs
(Contract N00014-77-C-0311)
(AD-A052466; TR-1) Avail: NTIS HC A03/MF A01 CSCL 11/9

Three diblock copolymers of cis-1-4 polyisoprene (IR) and 1-4 polybutadiene (BR) have been studied in dynamic mechanical experiments, transmission electron microscopy and thermomechanical analysis. The block copolymers had molar ratios of 1/2, 1/1 and 2/1 for the isoprene and butadiene blocks. Homopolymers of polybutadiene and polyisoprene with various diene microstructures were also examined using similar experimental methods. Results indicate that in all three copolymers the polybutadiene and polyisoprene blocks are essentially compatible, whereas blends of homopolymers of similar molecular weights and microstructures were incompatible. Author (GRA)

N78-24363# California Univ., Berkeley. Dept. of Chemical Engineering.
PROPERTIES AND MORPHOLOGY OF AMORPHOUS HYDROCARBON BLOCK COPOLYMERS
Mitchel Shen 1 Mar. 1978 46 p refs Submitted for publication
(Contract N00014-75-C-0955)
(AD-A052441; TR-18) Avail: NTIS HC A03/MF A01 CSCL 11/9

The purpose of this review is to discuss the more recent advances in the investigation of the relation between the morphology of block copolymers and their properties. First we shall discuss the thermodynamic conditions under which homogeneous block copolymers can be formed. These homogeneous systems are interesting because their underlying chain dynamics can be treated by the accepted molecular models. Viscoelastic relaxation times computed from these theories are in good agreement with experimental data. Next we present some examples of block copolymer morphologies, taken from the electron micrographs now available in the literature. Statistical theories capable of satisfactorily explaining the observed morphologies are then briefly discussed. Finally the elastic, viscoelastic and rheological properties of these materials are described. In all instances the dominant influence of the microdomain structure on these properties is demonstrated. GRA

N78-24364# California Univ., Berkeley. Dept. of Chemical Engineering.
STRESS-STRAIN BEHAVIOR OF SOME ACRYLIC GRADIENT POLYMERS
C. F. Jasso, S. D. Hong, and M. Shen 10 Feb. 1978 17 p refs
(Contract N00014-75-C-0955)
(AD-A052617; TR-17) Avail: NTIS HC A02/MF A01 CSCL 11/9

Multicomponent polymers whose structure or composition varies as a function of position in the sample are called gradient polymers. One way to prepare gradient polymers is to permit a guest monomer to diffuse into a host polymer network. The resulting profile of the diffusion gradient is fixed by polymerizing the monomer in situ. In this work, we used 2-chloroethyl acrylate as the monomer and poly(methyl methacrylate) as the polymer matrix. Both gradient polymers and interpenetrating networks were prepared. It was found that the stress-strain behavior of gradient polymers is quite different from that of the interpenetrating networks of comparable composition. The former shows a yield point, and considerably enhanced fracture strain. The latter is essentially rubber in character. Possible mechanisms for the unique properties of gradient polymers are discussed.
Author (GRA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N78-24365* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ATOMIC HYDROGEN STORAGE METHOD AND APPARATUS Patent
John A. Woollam, inventor (to NASA) Issued 7 Mar. 1978 4 p Filed 13 Apr. 1976 Supersedes N76-22399 (14 - 13, p 1644)
(NASA-Case-LEW-12081-1; US-Patent-4,077,788; US-Patent-Appl-SN-676432; US-Patent-Class-62-48; US-Patent-Class-34-15; US-Patent-Class-62-100; US-Patent-Class-250-492R; US-Patent-Class-423-648R) Avail: US Patent Office CSCL 21D

Atomic hydrogen, for use as a fuel or as an explosive, is stored in the presence of a strong magnetic field in exfoliated layered compounds such as molybdenum disulfide or an elemental layer material such as graphite. The compound is maintained at liquid helium temperatures and the atomic hydrogen is collected

on the surfaces of the layered compound which are exposed during delamination (exfoliation). The strong magnetic field and the low temperature combine to prevent the atoms of hydrogen from recombining to form molecules.
Official Gazette of the U.S. Patent Office

N78-24366 South African Bureau of Standards, Pretoria.
CODE OF PRACTICE FOR THE PETROLEUM INDUSTRY. PART 1: THE HANDLING, STORAGE, AND DISTRIBUTION OF PETROLEUM PRODUCTS
Jun. 1977 165 p In AFRIKAANS and ENGLISH
(SABS-089-1977-Pt-1; ISBN-0-626-04348-4) Copyright. Avail: Issuing Activity

Practices are recommended for the layout, design, and operation of petroleum marketing installations and depots, and for the installation of equipment of the types normally used for the handling, storage, and distribution of petroleum products and their derivatives, other than of equipment used for storage and dispensing at consumer premises (including service stations). Author

N78-24367 South African Bureau of Standards, Pretoria.
CODE OF PRACTICE FOR THE SAMPLING OF COAL AND PREPARATION OF A SAMPLE FOR ANALYSIS. PART 1: THE SAMPLING OF COAL
24 Aug. 1977 99 p In AFRIKAANS and ENGLISH
(SABS-0135-1977-Pt-1; ISBN-0-626-04422-7) Copyright. Avail: Issuing Activity

The principles and procedures are outlined to be followed when coal is sampled (after it has been mined) to provide samples for analysis. Author

N78-24368 South African Bureau of Standards, Pretoria.
CODE OF PRACTICE FOR THE SAMPLING OF COAL AND PREPARATION OF A SAMPLE FOR ANALYSIS. PART 2: PREPARATION OF A SAMPLE FOR ANALYSIS
24 Aug. 1977 58 p In AFRIKAANS and ENGLISH
(SABS-0135-1977-Pt-2; ISBN-0-626-04423-5) Copyright. Avail: Issuing Activity

This part of the code of practice covers the procedure to be followed and the precautions to be observed when samples for analysis are prepared from the original sample. Author

N78-24369*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPACT OF FUTURE FUEL PROPERTIES ON AIRCRAFT ENGINES AND FUEL SYSTEMS
R. A. Rudey and J. S. Grobman 1978 33 p refs To be presented at Lecture Ser. 96, Paris, Munich, and London, 12-20 Oct. 1978; sponsored by AGARD
(NASA-TM-78866; E-9597) Avail: NTIS HC A03/MF A01 CSCL 21D

This paper describes and discusses the propulsion-system problems that will most likely be encountered if the specifications of hydrocarbon-based jet fuels must undergo significant changes in the future and, correspondingly, the advances in technology that will be required to minimize the adverse impact of these problems. Several investigations conducted are summarized. Illustrations are used to describe the relative effects of selected fuel properties on the behavior of propulsion-system components and fuel systems. The selected fuel properties are those that are most likely to be relaxed in future fuel specifications. Illustrations are also used to describe technological advances that may be needed in the future. Finally, the technological areas needing the most attention are described, and programs that are under way to address these needs are briefly discussed.
Author

N78-24370*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARACTERISTICS AND COMBUSTION OF FUTURE HYDROCARBON FUELS
R. A. Rudey and J. S. Grobman 1978 26 p Proposed for presentation at Lecture Series 96, Paris, Munich, London, 12-20 Oct. 1978; sponsored by AGARD
(NASA-TM-78865; E-9596) Avail: NTIS HC A03/MF A01 CSCL 21D

As the world supply of petroleum crude oil is being depleted, the supply of high-quality crude oil is also dwindling. This dwindling supply is beginning to manifest itself in the form of crude oils containing higher percentages of aromatic compounds, sulphur, nitrogen, and trace constituents. The result of this trend is described and the change in important crude oil characteristics, as related to aircraft fuels, is discussed. As available petroleum is further depleted, the use of synthetic crude oils (those derived from coal and oil shale) may be required. The principal properties of these syncrudes and the fuels that can be derived from them are described. In addition to the changes in the supply of crude oil, increasing competition for middle-distillate fuels may require that specifications be broadened in future fuels. The impact that the resultant potential changes in fuel properties may have on combustion and thermal stability characteristics is illustrated and discussed in terms of ignition, soot formation, carbon deposition flame radiation, and emissions. Author

N78-24371*# Cohen (Norman) Professional Services, Redlands, Calif.
NITRAMINE SMOKELESS PROPELLANT RESEARCH Final Report
28 Nov. 1977 62 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954715)
(NASA-CR-157150; JPL/AFOSR-77-F) Avail: NTIS HC A04/MF A01 CSCL 21I

A transient ballistics and combustion model was derived to represent the closed vessel experiment that is widely used to characterize propellants. The model incorporates the nitramine combustion mechanisms. A computer program was developed to solve the time dependent equations, and was applied to explain aspects of closed vessel behavior. It is found that the rate of pressurization in the closed vessel is insufficient at pressures of interest to augment the burning rate by time dependent processes. Series of T-burner experiments were performed to compare the combustion instability characteristics of nitramine (HMX) containing propellants and ammonium perchlorate (AP) propellants. It is found that the inclusion of HMX consistently renders the propellant more stable. Author

N78-24372# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE DETERMINANTS OF THE DEMAND FOR RESIDUAL FUEL OIL IN THE U.S. EAST COAST MARKET, 1960-1976 M.S. Thesis
Ray Martin Cole, Jr. Dec. 1977 146 p refs In SPANISH; ENGLISH summary
(AD-A051131; AFIT-CI-78-19) Avail: NTIS HC A07/MF A01 CSCL 21/4

This thesis is a study of the demand for a primary export product of Venezuela which is, as well, an important imported fuel with respect to the East Coast of the U.S. The objectives are: (1) to determine the most likely factors which bear upon the demand for fuel oil on the East Coast; (2) to pose and estimate an econometric model for the demand; and (3) to attempt short-range forecasts with the model. A prior economic study reveals the most likely variables which are then incorporated in two possible models which are thought to reflect the reality of the demand. The best specified models reveal that the essential factors of the demand are: (1) the lagged demand; (2) the price spread between fuel oil and coal; and (3) income per capita. Subsequent forecasts of the demand, given the same historical conditions which are the basis for the model, signal a reduction through 1980. This conclusion is important to Venezuela because of her position as a marginal supplier and a certain inflexibility in her hydrocarbon export package. Author (GRA)

N78-24373# IIT Research Inst., Chicago, Ill.
BLAST PARAMETERS AND OTHER CHARACTERISTICS OF N5 PROPELLANT Interim Report
Shepherd Levmore and James J. Swatosh, Jr. Dover, N. J. Army Armament Res. and Develop. Command Dec. 1977 77 p refs
(Contract DAAA21-74-C-0188)
(AD-A051349; AD-E400041; ARLCD-TR-77023) Avail: NTIS HC A05/MF A01 CSCL 21/9

The peak pressures and positive impulses resulting from detonating inprocess and final product forms of N5 in the scaled distance range of approximately 2.5 to 40 ft/lb to the 1/3 power

were measured. Variables considered included booster size and propellant weight and configuration. The MK 43-1 2.75- inch rocket grain registered the greatest TNT equivalency at 9 ft/lb to the 1/3 power; peak pressure was 250%, and scaled positive impulse 145%. All other forms of N5 registered lower airblast readings. Author (GRA)

N78-24374# United Technology Corp., Sunnyvale, Calif. Chemical Systems Div.
THE 84-INCH PROPELLANT CARTRIDGES AND GRAINS. VOLUME 2: PROPELLANT TEST DATA Final Report, Nov. 1975 - Nov. 1977
Terry V. OHara, Joe B. Henry, and Wendell A. Stephen 30 Nov. 1977 275 p
(Contract F04611-76-C-0010; AFRPL Order 305909)
(AD-A051742; CSD-2579-FR-Vol-2; AFRPL-TR-77-92-Vol-2)
Avail: NTIS HC A12/MF A01 CSCL 21/9

For abstract, see N78-24378.

N78-24375# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STEAM REFORMING OF METHYL FUEL, PHASE 1 Final Report
D. J. Cerini, R. D. Shah, and G. E. Voecks Jun. 1977 142 p
(AD-A044787; JPL-5030-131) Avail: NTIS HC A07/MF A01 CSCL 07/3

An experimental study was made on the effects of gasoline contamination of methanol relative to steam reforming of the mixture. At the conventional steam reforming temperature of 350-400 F soot was produced with a 90/10 mixture of methanol and gasoline by weight. A parametric study was conducted to evaluate the effects of higher temperature and higher steam to carbon ratio with four different catalysts. Soot-free operation was obtained with Girdler catalyst T-2107 at an operating temperature of 750 F at a steam to total carbon ratio of 3.8. Essentially all the gasoline is converted into light gaseous hydrocarbons, primarily methane. A trace of light-yellow oil droplets could be detected in the cooled product gas condensate. A 100 hour test showed no deterioration of the T-2107 catalyst activity under the above conditions. Author (GRA)

N78-24376# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
SOLID PROPELLANT ADMITTANCE MEASUREMENTS BY THE DRIVEN TUBE METHOD Final Report, 30 Jun. 1973 - 30 Sep. 1977
B. T. Zinn, B. R. Daniel, W. A. Bell, and M. Salikuddin Oct. 1977 40 p refs
(Grant AF-AFOSR-2571-73; AF Proj. 2308)
(AD-A052537; AFOSR-78-0548TR) Avail: NTIS HC A03/MF A01 CSCL 21/9

The progress made during the fourth year of an investigation for the measurement of the response of a burning solid propellant to flow disturbances is presented. In this study a modification of the impedance tube technique is used to measure the response over a wide frequency range. Further refinements in the data reduction computer program are discussed. Anomalous behavior for high pressure (300 psig) tests which shows that the propellant sample periodically drives and damps acoustic oscillations during a burn was resolved. Techniques for improving the accuracy of the measured data and the quality of the burn have been developed. Testing will resume during the next year.
Author (GRA)

N78-24377# United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
ROTATING VALVE FOR VELOCITY COUPLED COMBUSTION RESPONSE MEASUREMENTS Interim Report, 1 Jan. 1977 - 9 Jan. 1978
R. S. Brown Feb. 1978 21 p refs
(Contract F49620-77-C-0048; AF Proj. 2308)
(AD-A052540; CSD-2624-1SR-1; AFOSR-78-0521TR) Avail: NTIS HC A02/MF A01 CSCL 21/9

Quantitative measurement of the velocity coupled response function is required for quantitative predictions of the combustion stability characteristics of rocket motors. Velocity oscillations of controlled frequency and magnitude can be generated in a test motor by simultaneously operating a rotating valve at each end of the motor, 180 deg out of phase. Analytical studies have developed a transient ballistics model for the one dimensional flow in the test motor. The analysis incorporates velocity coupling, pressure coupling, and particle damping effects. The model reduces to previously developed approximate solutions of the mass, momentum, and energy equations. In addition, the analysis predicts the stability characteristics for one dimensional acoustic oscillations. Approximate solutions were developed for deriving velocity coupled response functions and potentially particle parameters from experimental pressure measurements. Experimental tests have shown cold flow ballistics are concurrently modeled by the analysis when the two valves are in phase. Thus, the internal geometries are ballistically sound. Velocity coupled cold flow tests show significant pressure amplitude modulations which were traced to mechanical tolerance buildups. Methods are under study for reducing this buildup and for eliminating residual tolerance effects by appropriate cold flow calibrations. Author (GRA)

N78-24378# United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
THE 84-INCH PROPELLANT CARTRIDGES AND GRAINS Final Report, Nov. 1975 - Nov. 1977
Terry V. OHara, Joseph B. Henry, and Wendell A. Stephen 30 Nov. 1977 157 p
(Contract F04611-76-C-0010)
(AD-A052774; CSD-2579-FR-Vol-1; AFRPL-TR-77-92-Vol-1)
Avail: NTIS HC A08/MF A01 CSCL 21/9

This document reports the results obtained from casting a total of 30 84 inch cartridges with UTP-18,803A propellant (90% solids, 21% aluminum, HTPB). Both ballistic and mechanical property data obtained during the production of over 730,000 lbs of propellant is presented. Documentation for propellant production is provided. Author (GRA)

N78-24379# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
BEHAVIOR OF ALUMINUM IN SOLID PROPELLANT COMBUSTION Final Scientific Report, 1 Sep. 1975 - Sep. 1977
E. W. Price, R. K. Sigman, and J. K. Sambamurthi Nov. 1977 16 p refs
(Grant AF-AFOSR-2912-76; AF Proj. 2308)
(AD-A052492; AFOSR-78-0468TR) Avail: NTIS HC A02/MF A01 CSCL 11/6

The usefulness of powdered aluminum as a propellant ingredient is compromised by the details of its behavior in the combustion zone, its combustion in the motor volume, and by the nature of the product oxide droplets. This project was aimed at clarification of the mechanisms governing concentration, sintering and agglomeration of aluminum on the propellant burning surface, subsequent combustion of agglomerated aluminum, and resulting size distribution of the Al2O3 product droplets. The approach was to study the response of individual propellant ingredients, and combinations, to controlled heating in laboratory experiments such as hot stage microscope and hot plate apparatus. GRA

N78-24380*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PERFORMANCE EVALUATION OF A CATALYTIC PARTIAL OXIDATION HYDROGEN GENERATOR USING TURBINE ENGINE FUELS Final Report, 1 Oct. 1976 - 30 Apr. 1977
Richard M. Clayton Oct. 1977 43 p refs
(Contract MIPR-FY14557-601611)
(AD-A047355; AFAPL-TR-77-62) Avail: NTIS HC A03/MF A01 CSCL 21/4

Operation of a catalytic partial oxidation reactor under simulated turbine engine idle power air state conditions, using a conventional aviation turbine fuel (JP-5) and an unconventional fuel (blend of JP-5/xylene), is shown to produce a 'fuel gas' stream of near theoretical equilibrium composition at very fuel-rich A/F ratios in the range of 5.0-5.6. The combustibles in the fuel gas comprise about 6% H2 and 93% CO by mass and therefore, the fuel gas exhibits superior lean-burning qualities relative to the fuel gas exhibits superior lean-burning qualities

relative to the fuel feed stock. The concept of using the very fuel-rich partial oxidation process as a first stage of a two-stage combustion system for onboard processing of broadened specification fuels to improve their combustion characteristics is discussed. For the nonoptimal reactor design used, excessive catalyst bed temperatures and a propensity for solid carbon deposition in the bed were observed. These phenomena are not fully understood and need further elucidation. Thermal reactor schemes (without catalysts) may be more advantageously applied to aviation turbine engines but these schemes also require additional investigation to delineate design requirements.
Author (GRA)

N78-24381# Stanford Research Inst., Menlo Park, Calif.
CHARACTERIZATION OF INITIATION AND DETONATION BY GAGE TECHNOLOGY Final Report
M. Cowperthwaite and J. T. Rosenberg Jul. 1977 57 p refs
(Contract EY-76-C-03-115)
(UCRL-13760) Avail: NTIS HC A04/MF A01

Theoretical and experimental studies were performed to establish guidelines for applying the Lagrange gage and analysis technique to the determination of constitutive relations and energy release rates in shocked explosives. In this technique constitutive relations are determined by integrating the continuity and momentum equations using gage measurements of Lagrange stress and/or particle velocity histories as input; volumetric energy release rates are calculated from the energy equation and from a specification of the frozen sound speed with no other assumptions. This information is required to formulate realistic mathematical models of initiation and detonation for use in hydrocode calculations related to the response and safety of explosives.
ERA

N78-24382# Institute of Gas Technology, Chicago, Ill.
RESEARCH AND DEVELOPMENT OF RAPID HYDROGENATION FOR COAL CONVERSION TO SYNTHETIC MOTOR FUELS (RISER CRACKING OF COAL) Annual Report, 1 Apr. 1976 - 31 Mar. 1977
D. A. Duncan, J. L. Beeson, and R. D. Oberle Jun. 1977 54 p refs
(Contract EX-76-C-01-2307)
(FE-2307-17) Avail: NTIS HC A04/MF A01

The use of a short residence-time riser reactor, of the type used in contemporary catalytic cracking was extended to the conversion of coals and lignites to gaseous and liquid products by reaction with gases such as hydrogen, synthesis gas, or mixtures of carbon monoxide and steam. The gases also carry the feed coal through the riser reactor. A maximized production of high-octane gasoline constituents (C4 to 400 F boiling range including BTX) is an improtant aspect of this investigation. Light gases (C1 to C3) will also be produced and will contain substantial proportions of methane and other light hydrocarbons that could be used either for fuel or for petrochemical feedstock. Spent char would be used for synthesis gas or hydrogen production for use in the riser reactor.
ERA

N78-24383# Sandia Labs., Albuquerque, N. Mex.
POTENTIAL FUEL PRODUCTION FROM MAGMA
C. J. M. Northrup, Jr., T. M. Gerlach, P. J. Modreski, and J. K. Galt Jun. 1977 33 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0509) Avail: NTIS HC A03/MF A01

Recent calculations and measurements indicate that basaltic magma is a new, extensive source for fuels (hydrogen, carbon monoxide, and methane). The fuel production processes are found to occur in nature as well as the laboratory and as a result, the work indicates that current concepts of geothermal energy can be broadened beyond producing only steam and heat. When magma is considered as a geothermal resource, its use for the direct production of fuels should be included. It is possible to generate several mole percent hydrogen when water-rich fluid is equilibrated with the ferrous and ferric iron in magma. The basis of the fuel production processes, the fuel yields for injected water and water plus natural organic matter, and the increased geothermal resources that would be made available by these processes are described.
ERA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N78-24384 South African Bureau of Standards, Pretoria.
CODE OF PRACTICE FOR DETAILING OF STEEL REINFORCEMENT FOR CONCRETE
8 Mar. 1978 197 p
(SABS-0144-1978; ISBN-0-626-04529-0) Copyright. Avail: Issuing Activity

This code of practice covers the recommended methods for detailing steel reinforcement for concrete and is applicable to all reinforced concrete, except prestressed concrete.
Author

N78-24385# National Bureau of Standards, Washington, D. C.
PROBLEMS IN WORLD-WIDE STANDARDIZATION OF THE UNITS OF HEIGHT MEASUREMENT Interim Report
Judith F. Gilsinn Feb. 1978 23 p refs
(Contract DOT-FA76WAI-594)
(AD-A051150; NBSIR-77-1386; FAA-EM-78-2) Avail: NTIS HC A02/MF A01 CSCL 17/7

The U.S. commitment to a voluntary conversion to metric units raises changeover problems in the fields of air traffic control and airspace management. Current practice in altitude measurement and the rules for height maintenance now in effect worldwide are discussed. Four desirable features are given for an altitude measurement system, encompassing both the units of height measurement and the designation of cruising levels. Three alternative bases for the design of such a system are described and related to the desirable characteristics. Problems associated with each of the approaches were examined and the many factors to be considered and the many interrelationships involved were studied.
Author

N78-24386*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD AND APPARATUS FOR SLICING CRYSTALS Patent Application
John S. J. Benedicto, Bruce E. Woodgate, and Federick C. Hallberg, inventors (to NASA) Filed 15 May 1978 13 p
(NASA-Case-GSC-12291-1; US-Patent-Appl-SN-906298) Avail: NTIS HC A02/MF A01 CSCL 13H

A method and apparatus are described for slicing crystals into slices having a thickness on the order of 5 mils. The concept involves slicing a crystal having flat, opposed, parallel end faces. This is accomplished by cleaving the crystal while the two opposed parallel end faces are gripped and are being urged apart, so that a sliced portion of the crystal, including the first face, is pulled away from the remainder of the crystal when the crystal has been cleaved. An important feature of the invention is that the gripped face that is pulled away from the remainder of the crystal is held on the platen by a vacuum.
NASA

N78-24387*# National Aeronautics and Space Administration. Pasadena Office, Calif.
UNDERGROUND MINERAL EXTRACTION Patent Application
Charles G. Miller (JPL) and James B. Stephens, inventors (to NASA) Filed 19 Apr. 1978 27 p
(Contract NAS7-100)
(NASA-Case-NPO-14140-1; NASA-Case-NPO-14381-1; US-Patent-Appl-SN-897832) Avail: NTIS HC A03/MF A01 CSCL 08I

A method is described for mining coal or other minerals from underground seams without requiring personnel underground. The method involves a jet head which emits a high pressure water stream in a coal seam to comminute the coal around the jet heat as it moves along a passage that is cuts in the seam. The jet head is connected to a pipeline that extends along the passage and up to the surface of the earth where a pumper rig pumps water from a water line into the pipeline. The coal slurry resulting from the mixture of water and comminuted coal, flows down an inclined passage to a previously cut drain gallery that carries the slurry to a lifting apparatus so it can be pumped into a slurry pipeline. Each passage cut in the coal seam is formed by advancing the jet head forwardly, while the head

emits water in a forward direction to cut a pilot hole. Then the jet head retreats along the pilot hole while emitting water sidewardly to comminute coal along a wide passage. The effectiveness of the jet heat in breaking up coal is increased by injecting droplets of an explodeable material into the water stream. The droplet vaporizes to produce an explosion that drives a water slug into cracks in the seam and helps fracture the coal.
NASA

N78-24388# National Technical Information Service, Springfield, Va.
SUPERFLUIDITY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978
George W. Reimherr Mar. 1978 162 p Supersedes NTIS/PS-77/0249; NTIS/PS-76/0199
(NTIS/PS-78/0242; NTIS/PS-77/0249; NTIS/PS-76/0199) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 20K

Superfluidity in liquid helium is examined, with both helium 3 and helium 4 considered. Topics discussed include phase studies, heat transfer, hydrodynamics, rotons, zero sound, first sound, second sound, third sound, and fourth sound. GRA

N78-24389# Dunlap and Associates, Inc., La Jolla, Calif.
ACCIDENT AND NEAR ACCIDENT CAUSATION: THE CONTRIBUTION OF AUTOMOBILE DESIGN CHARACTERISTICS Final Report, 19 Jun. 1976 - 28 Feb. 1977
William J. Burger, Russell L. Smith, John E. Queen, and Graham B. Slack Nov. 1977 212 p refs
(Contract DOT-HS-5-01216)
(PB-274338; DOT-HS-802-714) Avail: NTIS HC A10/MF A01 CSCL 13F

A study was conducted to (1) determine the frequency and severity of driver/vehicle design mismatch problem contribution to accidents and near accidents, (2) relate driver and vehicle characteristics to severity and frequency of problems experienced by drivers, (3) develop and validate the method used to measure mismatch problem and (4) identify vehicle design countermeasures which would reduce problem frequency or severity. Five direct mail questionnaires were developed and pilot tested on a sample of 800 U.S. Government employees. Results were analyzed and a modified questionnaire recommended for a large scale survey of drivers. The questionnaire contained questions on vision, controls, steering, braking, shifting, and seating. Subsequently, a direct mail survey was conducted by three private institutions which surveyed 10,000 drivers. GRA

N78-24390# Environmental Protection Agency, Washington, D. C.
VALUE ENGINEERING: CASE STUDIES AND FORMATS FOR PROPOSALS AND REPORTS. A SUPPLEMENT TO THE VALUE ENGINEERING WORKBOOK FOR CONSTRUCTION GRANTS PROJECTS
Jun. 1977 145 p
(PB-277481; EPA-430/9-77-009; MCD-27) Avail: NTIS HC A07/MF A01 CSCL 13B

This report provides guidance on formats for Value Engineering (VE) study proposals and reports; guidance on the appropriate level of VE effort and VE team composition; and case studies on five wastewater projects which are subjected to VE and EPA's voluntary VE program. GRA

N78-24225*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LAASP 100-m ANTENNA WIND PERFORMANCE STUDIES
R. Levy and M. S. Katow *In its* The Deep Space Network 15 Apr. 1978 p 104-113, refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 20K

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N78-24391* National Aeronautics and Space Administration. Pasadena Office, Calif.
THIN CONFORMAL ANTENNA ARRAY FOR MICROWAVE POWER CONVERSIONS Patent
Richard M. Dickinson, inventor (to NASA) (JPL) Issued 14 Mar. 1978 8 p Sponsored by NASA
(NASA-Case-NPO-13886-1; US-Patent-4,079,268; US-Patent-Appl-SN-730045; US-Patent-Class-307-151; US-Patent-Class-361-395; US-Patent-Class-343-700MS) Avail: US Patent Office CSCL 09C

A structure of a circularly polarized, thin conformal, antenna array which may be mounted integrally with the skin of an aircraft employs microstrip elliptical elements and interconnecting feed lines spaced from a circuit ground plane by a thin dielectric layer. The feed lines are impedance matched to the elliptical antenna elements by selecting a proper feedpoint inside the periphery of the elliptical antenna elements. Diodes connected between the feed lines and the ground plane rectify the microwave power, and microstrip filters (low pass) connected in series with the feed lines provide dc current to a microstrip bus. Low impedance matching strips are included between the elliptical elements and the rectifying and filtering elements.
Official Gazette of the U.S. Patent Office

N78-24392 British Broadcasting Corp., Kingswood (England). Research Dept.
ELECTRONIC NEWS-GATHERING: THE EFFECT OF MULTIPATH PROPAGATION
C. Gandy Apr. 1978 17 p
(BBC-RD-1978/11) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The use of u.h.f. or s.h.f. radio links for electronic news-gathering (ENG) has posed many problems in built-up areas. Presently the major obstacle is multipath propagation caused by reflection of the signal off the walls of buildings and other structures. A series of tests was conducted in the center of London in order to measure the multipath signal strengths and echo delays that could be expected on typical ENG transmission paths. The a.m. pulse system that was used gave results with greater definition than those provided by previous tests. For each transmission path that was investigated different frequency bands (2-5 GHz and 12 GHz) and aerial polarizations were used. The results are presented in the form of photographs of video waveforms and received pulses, together with a tabulation of measured signal-strengths, video signal-to-noise ratios, and values of echo signal-strength and delay. The results are analyzed to show which factors affect the multipath performance of each link. Author

N78-24393 British Broadcasting Corp., Kingswood (England). Research Dept.
A PROPOSED METHOD OF DATA TRANSMISSION FROM uhf RELAY STATIONS FOR REMOTE MONITORING
P. Shelswell Apr. 1978 16 p refs
(BBC-RD-1978/12) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A new system to provide a data link between a u.h.f. television relay station and a monitoring and information center was examined. It shows that data can be transmitted with the broadcast signal and received outside the normal service area. There is a brief description of a practical test of the link. Author

N78-24394 British Broadcasting Corp., Kingswood (England). Engineering Div.
COMPUTER PROGRAMS FOR VHF INTERFERENCE PREDICTION USING A TERRAIN DATA BANK
J. H. Causebrook and B. Tait Apr. 1978 16 p refs
(BBC-RD-1978/13) Copyright. Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A set of computer programs was written to aid broadcast service planning work in the VHF bands. They were intended for FM sound in band 2 as well as new television and other possible services in bands 1 and 3. The prime object was the prediction of interference levels from other transmitters into a service area. The methods were an extension of those employed for UHF where terrain and transmitter data banks were used.
Author

N78-24395# Royal Aircraft Establishment, Farnborough (England).

INVESTIGATION INTO A NOVEL MIXING METHOD FOR VIDEO SIGNALS

N. Franke Nov. 1977 20 p refs Transl. into ENGLISH from Rundfunktech. Mitt. (West Ger.), v. 11, no. 4, 1967 p 196-202

(RAE-Lib-Trans-1946; BR62015) Avail: NTIS HC A02/MF A01

A method for mixing video signals (nonadditive mixing) was introduced, in which an electronic switch controlled by the instantaneous value of the applied signals, always feeds the strongest signal to the output. In this way, the output signal can never be stronger than the strongest input signal, which is advantageous for use in mixers and faders. After explaining the principle, a simple circuit for utilizing the method was indicated. Designs were developed for equipment for the various functions of vision control, such as mixing and fading, special effects and caption inlay, and these were compared, as regards their cost and effect, with equipment of conventional design. Particular attention was given to operation with coded colour signals. Author

N78-24396*# Gustincic (J. J.) Consulting Engineer, Marina Del Rey, Calif.

A QUASI-OPTICAL FLIGHT MIXER Final Report

1 Jan. 1978 27 p refs

(Contracts NAS7-100; JPL-954492)

(NASA-CR-156980; TR-081) Avail: NTIS HC A03/MF A01 CSCL 20F

A mechanically stable single block mixer design is described utilizing a recessed whisker and beamwidth equalization lens. A stripline I.F. matching section which is an integral part of the mixer is presented. Engineering measurements of wire grids and dielectric transmission loss near one millimeter wavelength are given and an anomolous I-V curve behavior observed during diode whiskering is discussed. Author

N78-24397# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.

SURVEYS OF ELECTROMAGNETIC FIELD INTENSITIES NEAR REPRESENTATIVE HIGHER-POWER FAA TRANSMITTING ANTENNAS Final Report, 1974 - 1976

Ezra B. Larsen and John F. Shafer Dec. 1977 114 p refs

(Contract DOT-FA73WAI-388)

(AD-A051717; NBSIR-76-849; ; FAA-RD-77-179) Avail: NTIS HC A06/MF A01 CSCL 09/1

The typical FAA transmitters surveyed include aircraft radars, ground surveillance radars, instrument, landing systems, navigation equipment, and communication antennas. The surveys were made with rf radiation monitors having isotropic response patterns. Commercial monitors with thermocouple sensors were used to measure electric fields between 0.5 and 24 GHz and magnetic fields between 10 and 300 MHz. Probes designed at NBS with diode detectors were used for electric fields between 100 kHz and 10 GHz. Most of the radar surveys involved fixed antennas. Author

N78-24398*# Perkin-Elmer Corp., Costa Mesa, Calif. Applied Optics Div.

SYNTHETIC APERTURE RADAR CORRELATOR PHASE HISTORIES Final Report

Dec. 1977 275 p Sponsored by NASA Prepared for JPL

(Contract JPL-954582)

(NASA-CR-157086; Rept-6590) Avail: NTIS HC A12/MF A01 CSCL 17I

This report supplements the design of the following subsystems: (1) zoom azimuth telescope, zooming range from 3X to 6X. (2) range curvature correcting lenses. (3) Sphero-cylindrical shift lens. (4) Auxiliary lenses (tilted cylinder and matching lens). Author

N78-24399*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

RESEARCH IN MILLIMETER WAVE TECHNIQUES Semiannual Status Report, 15 Jun. - 15 Dec. 1977

R. W. McMillan 15 Jan. 1978 57 p refs

(Grant NsG-5012; GT/EES Proj. A-1642)

(NASA-CR-156763) Avail: NTIS HC A04/MF A01 CSCL 20N

During the past six months, efforts on this project have been devoted to: (1) continuation of construction and testing of a 6 GHz subharmonic mixer model with extension of the pumping frequency of this mixer to omega sub s/4, (2) construction of a 183 GHz subharmonic mixer based on the results of tests on this 6 GHz model, (3) ground-based radiometric measurements at 183 GHz, (4) fabrication and testing of wire grid interferometers, (5) calculations of reflected and lost power in these interferometers, and (6) calculations of the antenna temperature due to water vapor to be expected in down-looking radiometry as a function of frequency. Significant events during the past six months include: (1) Receipt of a 183 GHz single-ended fundamental mixer, (2) attainment of 6 db single sideband conversion loss with the 6 GHz subharmonic mixer model by using a 1.5 GHz (omega sub s/4) pump frequency, (3) additional ground-based radiometric measurements and (4) derivation of equations for reflection and loss for wire grid interferometers. Author

N78-24400*# National Aeronautics and Space Administration, Washington, D. C.

COMPARISON OF THE VARIOUS METHODS FOR THE DIRECT CALCULATION OF THE TRANSMISSION FUNCTIONS OF THE 15-MICRON CO2 BAND WITH EXPERIMENTAL DATA

May 1978 38 p refs Transl. by SCITRAN, Santa Barbara, Calif. Original doc. prep. by Acad. of Sci. USSR

(Contract NASw-2791)

(NASA-TM-75102) Avail: NTIS HC A03/MF A01 CSCL 20N

Various methods for calculating the transmission functions of the 15 micron CO2 band are described. The results of these methods are compared with laboratory measurements. It is found that program P4 provides the best agreement with experimental results on the average. Author

N78-24401*# National Aeronautics and Space Administration. Pasadena Office, Calif.

LIMITED SCAN DUAL-BAND HIGH GAIN ANTENNA Patent Application

Kenneth E. Woo (JPL) and Paul W. Cramer, inventors (to NASA) (JPL) Filed 28 Apr. 1978 11 p

(Contract NAS7-100)

(NASA-Case-NPO-14038-1; NASA-Case-NPO-14076-1; US-Patent-Appl-SN-901054) Avail: NTIS HC A02/MF A01 CSCL 17B

A dual-band, limited scan antenna with high gain and large aperture is comprised of a Cassegrainian antenna system with a dual-band phased array feed positioned so that the subreflector of the antenna system is in the near field of the feed, thereby enabling the antenna system to be scanned many beamwidths from boresight by phase scanning the feed. The phased array for scanning applications at S-band and X-band includes X-band waveguides in a matrix with S-band crossed-slot waveguides interleaved in the spaces between rows and columns of the X-band waveguides. NASA

N78-24402*# National Aeronautics and Space Administration. Pasadena Office, Calif.

VERSATILE TRANSPONDER RECEIVER Patent Application

Arthur J. Kline, inventor (to NASA) (Motorola, Scottsdale, Ariz.) Filed 28 Apr. 1978 10 p

(Contracts NAS7-100; JPL-953706)

(NASA-Case-NPO-14248-1; US-Patent-Appl-SN-901056) Avail: NTIS CSCL 17B

A versatile configuration is described for a transponder receiver using a VCO in a PLL to generate a retransmitted carrier at a frequency 2f sub 1. The second IF amplifier and bandpass filters operate at a frequency which is one-half the frequency of an offset oscillator. The output of the offset oscillator is added to the output of the first IF amplifier, while the frequency of the first IF amplifier is substracted, and then the offset frequency is effectively substracted in the loop phase detector. NASA

N78-24403*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A PORTABLE L-BAND VOICE TRANSCEIVER FOR SATELLITE COMMUNICATION

J. Maruschak and D. Nace Mar. 1978 30 p
(NASA-TM-78108) Avail: NTIS HC A03/MF A01 CSCL 17B

A portable L-band voice transceiver was developed as a feasibility model and can provide a half-duplex voice link to another terminal via the L-band transponder on the Applications Technology Satellite, ATS-6. The narrow band FM transceiver utilizes commercial subsystems including a UHF transceiver, provides an RF output power of 20 watts, weights less than 25 lbs., is housed in a plastic briefcase, can be powered by an automobile electrical system, and has been successfully operated with ATS-6 on numerous occasions. Design considerations and operation of the transceiver are described, along with alignment and testing procedures, packaging and cost considerations, subsystem performance requirements and overall transceiver performance characteristics. Author

N78-24404# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
CIDNP EXPERIMENTS WITH PULSED OPTICAL AND PULSED RADIO FREQUENCY EXCITATION Ph.D. Thesis [CIDNP - EXPERIMENTE MIT GEPULSTER OPTISCHER UND GEPULSTER RADIOFREQUENZANREGUNG]
Stefan Schaeublin 1976 149 p refs In GERMAN
(Diss-5775) Avail: NTIS HC A07/MF A01

The potentials, and limitations of chemical induced dynamic nuclear polarization experiments with pulsed optical and/or pulsed radiofrequency excitation are described. In the case of nonequilibrium states the Fourier relationship between slow passage and free induction decay is violated, in general. The relative signal intensities depend on the flip angle used in the Fourier experiment. In an experiment with pulsed optical and pulsed RF excitation, line intensities independent of nuclear relaxation can be obtained. When strongly coupled systems are involved, off-diagonal elements in the density matrix will occur. These oscillating off-diagonal elements will contribute to the transverse magnetization in a Fourier experiment. As an application, the kinetic of secondary reactions of unstable photochemical reaction products is investigated. By varying the delay between the light and the RF pulse the time behavior of all the products can be traced out directly. Author

N78-24405# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
MODULATION NETWORKS WITH DIGITAL FILTERS Ph.D. Thesis [MODULATIONSNETZWERKE MIT DIGITALEN FILTERN]
Christian Thoeny 1977 161 p refs In GERMAN; ENGLISH summary
(Diss-5956) Avail: NTIS HC A08/MF A01

The continous modulation of sinusoidal carriers could be achieved by the use of so called networks for multidimensional convolution operations. This approach was well suited for the application of digital techniques. A systematic investigation of these modulators yielded several procedures for their analysis and synthesis. The combination of pulse code modulation or delta modulation with nonrecursive or recursive filter structures resulted in four classes of modulators the properties of which were outlined. The design of recursive filters with delta modulation encountered certain stability problems. The stability of such filters has to be analyzed by methods for nonlinear systems because of nonlinear distortions in the region of slope overload. Author

N78-24406# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
BUFFERING AND FLOW CONTROL IN MESSAGE SWITCHED COMMUNICATION NETWORKS Ph.D. Thesis
Eberhard Frank Wunderlich Jan. 1978 225 p refs
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A051165; ESL-R-797) Avail: NTIS HC A10/MF A01 CSCL 17/2

The mathematical study of buffering and flow control is based on a gradual input queueing model. The gradual input model has been used previously to study data multiplexors. Here it is extended to an entire message switched communication network. A probability of buffer overflow analysis is developed and used to determine buffer requirements. A delay analysis is also developed. The results obtained using the gradual input queue are compared to the commonly used M/M/1 queue model for message switched networks. The gradual input model allows one to observe several effects due to a finite number of finite rate traffic sources in such networks that cannot be observed using the M/M/1 model. Flow control is studied in tree concentration structures. The flow control assures that buffer overflows will occur only at source nodes, not in the interior of the tree. The problem of finding the buffer allocation that minimizes the probability of buffer overflow in such a tree is studied. It is shown that in certain cases it is optimal to place all buffers at source nodes. This is, however, not always so and insight into this is given by example. Determining the performance of a tree structure in which flow control is being used is a difficult analytic problem. An approximate analysis based on a first passage time theorem for Markov chains is therefore developed for an example. The approximate analysis is verified by simulation. Author (GRA)

N78-24407# Naval Research Lab., Washington, D. C.
A UNIFIED TREATMENT OF EDGE-GUIDED WAVES Final Report
Pietro DeSantis 27 Jan. 1978 82 p refs
(ZF12151001)
(AD-A051297; AD-E000123; NRL-8158) Avail: NTIS HC A05/MF A01 CSCL 20/14

Edge-guided waves (EGW) are electromagnetic waves guided by the RF conductor edge of a ferrite stripline or microstrip circuit magnetized perpendicularly to the ground plane. EGW multi-octave isolators and circulators as well as nonreciprocal phase shifters have been constructed and used in operational systems. This report presents in a unified fashion and in a single text the results of the theoretical work on EGW propagation. Magnetic losses and a finite edge impedance are considered and shown to be responsible for the limitations on the broadband behavior of EGWs. Dielectric loading and curvature of the guiding edge, as well as fringing field effects, are also studied.
Author (GRA)

N78-24408# Naval Research Lab., Washington, D. C.
FREQUENCY-AGILE RADAR SIGNAL PROCESSING Interim Report
W. M. Waters and G. J. Linde 15 Nov. 1977 21 p refs
(ZF12151001)
(AD-A051305; AD-E000120; NRL-8141) Avail: NTIS HC A02/MF A01 CSCL 17/9

Modern radars may incorporate pulse-to-pulse carrier frequency modulation to increase probability of detection, to reduce vulnerability to jamming, and to reduce probability of interception. However, if coherent processing is used for clutter rejection, the frequency of N consecutive pulses must be held constant for N-pulse clutter cancellation or Doppler filtering. If M pulses are transmitted during the time the antenna illuminates a target, there are M/N coherently integrated echoes available for noncoherent integration in the computer or the operator's display to further improve the signal-to-noise ratio (SNR). In this report, analytical and simulation methods are employed to determine the balance between coherent and noncoherent integration that yields the greatest SNR improvement. Attention is focused upon three models which include FFT Doppler filtering and different systems of combining and noncoherently integrating Doppler filtered signals. Curves of detectable SNR as a function of M and N are presented for all three models. Author (GRA)

N78-24409# Naval Research Lab., Washington, D. C.
INVESTIGATION OF WIDEBAND DUAL MODE ANTENNAS EMPLOYING A SYMMETRICAL FEED NETWORK
R. E. Neidert, B. Sheleg, H. E. Heddings, and B. D. Wright Jan. 1978 11 p
(AD-A051298; AD-E000122; NRL-MR-3675) Avail: NTIS HC A02/MF A01 CSCL 09/1

A symmetrical network for a wideband (two-octave), dual mode spiral antenna for submarine periscope applications has been investigated. Performance results are compared with an antenna using conventional feed circuitry, and multipath-environment effects are discussed. Author (GRA)

N78-24410# Air Force Academy, Colo. Dept. of Economics, Geography and Management.
THE UTILIZATION OF SIDE LOOKING AIRBORNE RADAR

(SLAR) IN THE ANALYSIS OF KARST TOPOGRAPHY Final Report
Charles L. Smith and A. Paul Tribble Sep. 1977 37 p refs
(AD-A051330; USAFA-TR-77-13) Avail: NTIS HC A03/MF A01 CSCL 17/9

Characteristics of mechanical and synthetic radar systems are reviewed. Signature elements of Karst topography such as a vertical drainage pattern, knobs, and sinkholes are identified for Side Looking Airborne Radar (SLAR) imagery. SLAR imagery of the Kentucky Pennyroyal and Karst areas in Florida is presented with the signature elements highlighted. Applications of SLAR imagery to the identification and mapping of Karst areas in physically, climatologically, or politically inaccessible areas are addressed. Author (GRA)

N78-24411# SRI International Corp., Menlo Park, Calif.
RADAR TRACKING OF ION CLOUDS. TECHNICAL REPORT 1: PROJECT STRESS Interim Technical Report, Jul. 1976 - Mar. 1977
Victor H. Gonzalez Jul. 1977 58 p
(Contract DNA001-76-C-0341)
(AD-A051344; AD-E300103; DNA-4373Z; ITR-1) Avail: NTIS HC A04/MF A01 CSCL 17/9

Project STRESS utilized a series of high-altitude releases of barium that became ionized by solar radiation. The project required that the resulting ion cloud be tracked in real time, and this was accomplished by operating the AN/FPS-85 radar in the incoherent-scatter mode. This report describes the data-acquisition process and the tracking algorithm, and presents a preliminary look at the most important measurements obtained. The tracking of a Ba-ion cloud, attempted for the first time, was successfully accomplished for the time periods of up to 10 minutes. Author (GRA)

N78-24412# RCA Government Systems Div., Moorestown, N. J. Missile and Surface Radar.
CCD SIGNAL PROCESSOR STUDY Final Technical Report, May 1976 - May 1977
Lloyd W. Martinson, Brian P. Gaffney, and Gerard J. Mayer Dec. 1977 307 p refs
(Contract F30602-76-C-0280)
(AD-A051333; RADC-TR-77-422) Avail: NTIS HC A14/MF A01 CSCL 17/9

This report presents the results of a study of the application of charge coupled devices (CCD's) to radar signal processing systems. The particular radar problem considered was the detection of satellites at ranges of up to 25,000 NM. A CCD baseline design and tradeoffs are given for this problem. CCD devices were characterized in sufficient detail to construct an accurate computer simulation of their operation. The simulation included all known noise effects in CCD's in addition to the basic functional properties such as charge transfer inefficiency and dark current. Delay line and matched filter configurations were then synthesized from the CCD model and performance of various CCD subsystems ascertained as CCD parameters were varied. Parameter variations included CCD length, clock rate, gate size, tapped weight accuracy, charge transfer inefficiency, and temperature. Results are presented relating study results to achievable performance for various signal processing subsystems. Programmability, bandwidth limitations, sidelobe levels, dynamic range, and signal-to-noise considerations are addressed. Author (GRA)

N78-24413# Oregon State Univ., Corvallis. Dept. of Electrical and Computer Engineering.
ADVANCED FORWARD AREA TACTICAL RADAR NETWORK Interim Report
John D. Spragins 1977 46 p refs
(Grant AF-AFOSR-3339-77; AF Proj. 2304)
(AD-A051061; AFOSR-78-0202TR) Avail: NTIS HC A03/MF A01 CSCL 17/9

An advanced tactical radar network which is under conceptual development by the Air Force, with an anticipated installation date in the late 1980s, is described and some of the primary design choices are evaluated. The proposed radar network would provide revolutionary improvements in the quality of coverage by tactical radars by taking advantage of current trends in data processing and data communications. The heart of the network is a number of closely-spaced short-range 3-D radars which communicate with one another to share information about target tracks. All radars in the network are assumed to employ sophisticated data processing techniques to process target reports, with the resulting information communicated to all radars in the network through a grid of communication links. Each radar in the network will maintain a complete file of track reports for all targets seen by the network. The communication links used will also be available for other communications, command and control purposes. A variety of algorithms which may be used in the network are discussed, and some of the main problems to be faced in developing the network are pointed out. Author (GRA)

N78-24414# Michigan Univ., Ann Arbor. Radiation Lab.
ELECTROMAGNETIC SCATTERING Interim Report
Thomas B. A. Senior Dec. 1977 34 p refs
(Grant AF-AFOSR-3188-77)
(AD-A051072; Rept-015224-1-I; AFOSR-78-0197TR) Avail: NTIS HC A03/MF A01 CSCL 20/6

One of the major efforts has been in connection with the design of broadband absorbers to reduce the backscattering cross section of wing-like structures when illuminated at close to edge-on incidence with magnetic vector parallel to the edge. GRA

N78-24415# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
MILITARY DIGITAL MICROWAVE TRANSMISSION: PAST, PRESENT, FUTURE M.S. Thesis
Ronnie E. Brackett, Warren E. Carter, and John J. Soltis Aug. 1977 315 p refs
(AD-A051789; AFIT-CI-78-45) Avail: NTIS HC A14/MF A01 CSCL 17/2

This project treats the transmission of information in digital form over Military, line of sight, microwave systems. A concise history of the development of PCM technology is presented as a foundation for a discussion of technical, political, and regulatory problems encountered when converting from a fully analog system and environment to first, a quasi-digital environment, and then to a future all digital environment. Interwoven, are the motives for digital microwave transmission, and the functional relationships and dependencies which occur between various regulatory bodies, the Military, and the industrial manufacturers of communications hardware. The Military's Test and Evaluation approach to the DCS system conversion problem is examined, as is the implementation of the Military's first digital system. The final chapter provides an overview and perspective of the actions taken and of the Military future digital systems capability. Author (GRA)

N78-24416# Cincinnati Electronics Corp., Ohio.
VEHICULAR INTERCOMMUNICATION SYSTEM Quarterly Report, 30 Sep. - 30 Dec. 1977
C. F. Wedaman Mar. 1978 36 p
(Contract DAAB07-77-C-0190)
(AD-A052437; ECOM-77-0190-1; QR-1) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report represents progress of work performed in connection with Cincinnati Electronics: proposal for three means of reducing vehicle cable wiring for audio signal detection equipment: frequency division multiplexing, time division multiplexing and a totally wireless scheme. In addition to multiplexing, Cincinnati Electronics is studying means of achieving wireless audio accessories. GRA

N78-24417# Tulsa Univ., Okla.
RADAR SIGNATURES FOR AIRCRAFT IDENTIFICATION Final Scientific Report, Nov. 1976 - Dec. 1977
Robert D. Strattan 28 Feb. 1978 39 p refs
(Grant AF-AFOSR-3200-77)
(AD-A052447; AFOSR-78-0688TR) Avail: NTIS HC A03/MF A01 CSCL 17/9

A compact method of describing the radar scattering of distributed targets is developed. A computer program that processes the descriptor format into a target plane map of scattering intensity and forms simulated synthetic aperture radar images has been coded. Examples of aircraft and multiple reflection targets are shown. Author (GRA)

N78-24418# Naval Ocean Systems Center, San Diego, Calif.
PERSPECTIVE RADAR DISPLAY SYSTEM: TV-LIKE PRESENTATION ON CRT PROVIDES HIGHER LATERAL POSITION AND LATERAL MOTION SENSITIVITY THAN A PPI Technical Report, Mar. - Dec. 1977
L. G. Harris 17 Jan. 1978 21 p
(AD-A052342; NOSC/TR-198) Avail: NTIS HC A02/MF A01 CSCL 14/2

The data rate and display format of a conventional navigation radar/PPI display are adequate for most purposes but have limitations in certain close-range applications such as precision maneuvers in low-visibility conditions. At close ranges the PPI format bunches the close targets near the center of the scope where the inherent azimuth resolution is poorest. Close targets may make several degrees of change in relative bearing before the change is noticeable on the PPI display. Also, a small change in heading of 'own ship' is not immediately apparent on a PPI display. Radar Systems Company has developed a Perspective Radar Display System which provides a perspective presentation on a cathode ray tube of the volume of space being scanned by an electromechanical scanning (nonrotating) radar antenna. This type of display has higher lateral position and lateral motion sensitivity than a PPI display. It has the additional capability of varying the apparent altitude of perspective. This report covers a technical and operational evaluation of the Perspective Radar Display System to determine its effectiveness as an aid to piloting; for precision maneuvers in low-visibility conditions; for collision avoidance, intercept solution, and shadowing; and for aiding SEAL team cast and recovery operations. Author (GRA)

N78-24419# Computer Corp. of America, Cambridge, Mass.
A PACKET SPEECH MEASUREMENT FACILITY Final Technical Report, 1977
David A. Low 28 Feb. 1978 138 p refs
(Contract MDA903-77-C-0156)
(AD-A052338; CCA-78-05) Avail: NTIS HC A07/MF A01 CSCL 17/2

The Packet Speech Measurement Facility (PSMF) is an operational recording, playback, and measurement facility designed to provide NSC participants with a tool for packetized speech research. ARPANET access to the PSMF is available using the Network Voice Protocol (COHEN) and an appropriate extension (LOW). This section is intended to serve as a description of PSMF functions and a guide to their use. The three critical functions of the PSMF are recording, playback and measurement. The recording function enables a user to designate a PSMF file which will receive a record of negotiation proceedings, voice packets, and special control packets. The playback function provides the means for retrieving part of all of the recorded file. The measurement functions provide tools for analysis of recorded files, and typically create files which can be accessed via the playback function. A discussion of conventions and an outline of the PSMF extensions are followed by sections which detail each of the PSMF functions. Each function description is accompanied by the protocol necessary to access it, and an example of its use. Author (GRA)

N78-24420# Hughes Aircraft Co., Fullerton, Calif.
INVESTIGATION OF ARRAY TECHNIQUES FOR MULTIPLE BEAMS WITHIN LIMITED SPATIAL SECTORS Final Report, 15 May 1975 - 30 Sep. 1977
R. Tang, D. M. Joe, T. Olmos, and N. S. Wong Griffiss AFB, N. Y. RADC Dec. 1977 208 p refs
(Contract F19628-75-C-0196)
(AD-A052260; RADC-TR-429) Avail: NTIS HC A10/MF A01 CSCL 09/5

This report contains the results of a study program to devise and investigate light weight, compact antennas for forming multiple simultaneous independent beams within a limited spacial sector. The specific concept investigated in the report is the use of constrained feed overlapped subarray techniques for sidelobe control. The use of overlapping suppresses grating lobe radiation and allows wider subarray separation and inherently simpler and lighter beam forming matrices than are possible using conventional approaches. Author (GRA)

N78-24421# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROGRESS OF RUSSIAN TELECOMMUNICATION
Michael Jakubowicz 13 Dec. 1977 5 p Transl. into ENGLISH from Wiad. Telekomunikacyjne (Poland), v. 17, no. 4 p 100-102
(AD-A052551; FTD-ID(RS)T-2222-77) Avail: NTIS HC A02/MF A01 CSCL 17/2

The means of communication, television and radio broadcasting, within the USSR are being intensively improved based on general scientific-technical progress. Fundamental principles of a uniform automatized communication network form a general line of telecommunication development in the USSR. Three fundamental directions define the technical progress in the area of telecommunication. First of all is the creation of a technical and organizational unity of all means of communication with the arm of assuring their mutual cooperation, proportional development and most efficient utilization. GRA

N78-24422# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROTECTION OF SUBSCRIBERS AND WIRED RADIO-RELAY INSTALLATIONS FROM DANGEROUS VOLTAGES AND CURRENTS OCCURRING ON RADIO-RELAY NETWORK LINES
22 Dec. 1977 22 p Transl. into ENGLISH from Russian report GOST-14857-69, Moscow, 1969 p 1-14
(AD-A052550; FTD-ID(RS)T-2159-77) Avail: NTIS HC A02/MF A01 CSCL 17/2

By resolution of the Committee on Standards, Measures, and Measuring Instruments of the Council of Ministers USSR of 25/7/69 No. 843 the period of introduction is established from 1/1/70. Nonobservance of the Standard is subject to prosecution. This standard is disseminated to station, line, and subscriber facilities of urban and rural radio-relay networks (RN) and specifies systems and measures to protect them from dangerous voltages and currents occurring in RN lines during lightning discharges or upon contact between RN wires and high-voltage transmission lines (HL). GRA

N78-24423# Virginia Polytechnic Inst. and State Univ., Blacksburg.
PROCESSING SPATIALLY ALIASED ARRAYS
Melvin J. Hinich Sep. 1977 11 p refs
(Contract N00014-75-C-0494)
(AD-A052805; TR-10) Avail: NTIS HC A02/MF A01 CSCL 09/3

A linear array can detect a plane wave signal at a wrong bearing if the signal wavelengths are shorter than twice the distance between the closest adjacent sensors. This phenomenon, called spatial aliasing, is most pronounced when the bearing is near endfire. This paper presents a method for correcting spatial aliasing of broadband signals using the frequency-wavenumber approach to array processing. Also presented is a method for averaging the omega-kappa spectrum values that will give a more accurate bearing estimator than the method presented in a 1973 JASA article by Clay, Hinich and Shaman. The methods discussed in this paper can be used for a sparse unequally spaced array which is detecting a dispersive signal. Author (GRA)

N78-24424# Naval Research Lab., Washington, D. C. Radar Analysis Staff.
SURVEY OF RADAR SIGNAL PROCESSING Final Report
G. V. Trunk 21 Jun. 1977 49 p refs
(RR0210541)
(AD-A052560; NRL-8117) Avail: NTIS HC A03/MF A01 CSCL 17/9

During the last decade, considerable progress has been made in radar signal processing, and this report states its present status. The three broad areas of coherent processing, noncoherent detection, and track-while-scan systems are discussed. Specifically, in the area of coherent processing the subjects of sidelobe cancelers, adaptive radars, MTIs, and Doppler processing are discussed. In the adaptive processing area, both the maximum signal-to-noise and least mean-square methods are described, and special emphasis is given to the problem of convergent rate. The moving-target detector (MTD) is used as an example of Doppler processing. In the area of noncoherent detection,

various integrations are discussed. Among these are the moving window, feedback integrator, two-pole filter, binary integrator, and batch processor. Methods of obtaining a constant false-alarm rate using either adaptive thresholding or nonparametric detectors are also considered. Author (GRA)

N78-24425# Ohio State Univ., Columbus. Electroscience Lab.
BACKSCATTER OF A LARGE ROTATING CONDUCTING CYLINDER WITH ARBITRARY CROSS SECTION Interim Report
C. W. Chuang and A. A. Ksienski Feb. 1978 34 p refs
(Grant AF-AFOSR-2611-74)
(AD-A052414; AFOSR-78-0687TR; ESL-783815-4) Avail: NTIS HC A03/MF A01 CSCL 20/14

A quasi-stationary method in conjunction with GTD (geometrical theory of diffraction) techniques is used for calculating the backscattered field from a large rotating conducting cylinder with arbitrary cross section. Using this method, the scattered field at each time t is obtained as if the cylinder were stationary. The power density spectrum is then obtained using Fourier transformation. The backscatter power density spectrum of a large rotating cylinder consists of discrete spectral lines. For an orthogonal polygon-cylinder, the backscatter power density spectrum is symmetric about the incident frequency. A modal expansion solution is also obtained for verifying the results obtained by using GTD techniques. Author (GRA)

N78-24426# Hughes Aircraft Co., Fullerton, Calif.
NEAR FIELD ANTENNA MEASUREMENT SYSTEM Quarterly Report, 29 Aug. - 30 Nov. 1977
A. E. Holley 11 Jan. 1978 30 p
(Contract DAAB07-77-C-0587)
(AD-A052608; FR-78-14-338A; QR-1) Avail: NTIS HC A03/MF A01 CSCL 14/2

This report describes the first three months activity in the development of a fully self-contained automated near field antenna measurement facility. A description of the system is included. The primary efforts have involved purchasing of long lead hardware and equipment, mechanical design of the positioner structure, and outlining of software requirements. Author (GRA)

N78-24427# Bojarski (Norbert N.), Newport Beach, Calif.
A WAVE EQUATION FOR RADIATING SOURCE DISTRIBUTIONS
Norbert N. Bojarski Feb. 1978 13 p refs
(Contract N00014-76-C-0082)
(AD-A052590) Avail: NTIS HC A02/MF A01 CSCL 20/3

The Bleistein Cohen separation of a source (for the inhomogeneous Helmholtz wave equation) distribution into radiating and non-radiating portions is reformulated into a form suitable for deriving a wave equation governing the radiating portion of the source distribution. Author (GRA)

N78-24428# Simulation Physics, Inc., Bedford, Mass.
IEMP/SGEMP SIMULATION PROGRAM
R. G. Little, S. H. Face, R. A. Lowell, and W. A. Seidler Mar. 1977 91 p refs
(Contract DNA001-76-C-0134)
(AD-A052702; AD-E300146; SPI-FR-10041; DNA-4448F) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report presents the status of IEMP and SGEMP simulations with pulsed low voltage electron beams and describes certain low voltage bremsstrahlung X-ray environments. The techniques for producing electron beams of the appropriate characteristics and employing them in simulation geometries are described. The diagnostic approaches to characterizing both electron and X-ray environments are discussed. Data are presented for specific IEMP and SGEMP simulation examples. Low voltage bremsstrahlung environments produced using these pulsed electron beams are described. Author (GRA)

N78-24429# Mitre Corp., Bedford, Mass.
BUILDING BLOCKS FOR C3 SYSTEMS
J. A. Clapp and M. Hazle Mar. 1978 72 p refs
(Contract F19628-77-C-0001)
(AD-A052568; MTR-3504; ESD-TR-77-360) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report contains the results of a one-year study to assess the feasibility of constructing the information processing components of C3 systems from reusable building blocks. The objective is to reduce the time, cost, and risk of acquiring and modifying C3 computer systems. Three kinds of building blocks are identified: requirements, design, and software. A data flow architecture is proposed as a framework for partitioning a system into functional components with flexibility to adapt to changing requirements and different configurations. A preliminary plan is presented for further work to demonstrate the building block concept for C3 systems. Author (GRA)

N78-24430# Mission Research Corp., Santa Barbara, Calif.
AN AMBIENT HF RADIO MODE MODEL Topical Report, Feb. - Sep. 1977
D. H. Sowle Sep. 1977 57 p refs
(Contract DNA001-76-C-0349)
(AD-A052576; AD-E300150; MRC-R-347; DNA-4420T) Avail: NTIS HC A04/MF A01 CSCL 17/2

An approximate method for calculation of high frequency skywave radio propagation geometry is developed. The method is inexpensive in comparison to ray trace techniques yet capable of accounting for instantaneous local ionospheric conditions including tilt and off-great-circle propagation. It is thus appropriate for use in assessment of system response to nuclear effects on HF propagation, including alterations of mode geometry. Errors inherent in the approximations are shown to be small compared to errors caused by inaccuracies in ambient or disturbed ionospheric models. Author (GRA)

N78-24431# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
ESTIMATES OF SATELLITE-TO-EARTH MICROWAVE ATTENUATION BY CLOUD, RAIN, OXYGEN, AND WATER VAPOR
Allen R. Davis Apr. 1977 26 p refs
(AD-A052581; USAFETAC-8345) Avail: NTIS HC A03/MF A01 CSCL 20/14

This paper provides estimates of attenuation of space-to-earth radar transmissions due to cloud, rain, and gaseous factors. Attenuation of microwaves of 58-62 GHz and 92-96 GHz are examined. Attenuations through the atmosphere for elevation angles of 50.69 deg to 90 deg are calculated and 50, 95, and 99 percentile levels provided. Estimates are based on climatological frequencies of cloud amounts, rain rates, and water vapor, and are provided for two locations: one high-latitude temperate; the other, tropical. Author (GRA)

N78-24432# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
ENVIRONMENTAL EFFECTS ON 4/6 GHz ANIK 2 SATELLITE COMMUNICATION LINKS BETWEEN GREENLAND AND CALIFORNIA
Donald G. Buchanan Aug. 1977 88 p refs
(AD-A052580; USAFETAC-7681) Avail: NTIS HC A05/MF A01 CSCL 17/2

A 21-month data set from the AFCS satellite communication link between Point Reyes, CA and Pingorssuit-Mountain, Greenland exhibited seasonal 4to 6-GHz fading. The fading sources were concentrated along the high-latitude, low-elevation-angle (1.6 deg) side of the link. Local tropospheric storms coupling attenuation and interference produced short duration (1-3 days) signal fading during spring and summer seasons. The annual breakup of pack-ice in Baffin Bay from the June-August period allows specular reflection from the water surface to produce multipath fading on the signal record. Tropospheric subrefraction, local magnetic storms, hemispheric magnetic storms, interplanetary magnetic field sector boundary changes, and a Bartel's rotation showed some correlation with enhanced (higher frequency and amplitude) fading during the summer season. The 1974-76 data set coincides with low sunspot numbers during the solar cycle 20 trough. As the solar cycle activity increases toward maximum in the early 1980's we propose a coincident increase in the frequency of occurrence of enhanced signal fading.
Author (GRA)

N78-24433# Fondazione Ugo Bordoni, Rome (Italy).
EFFECT OF THE RAIN RATE PROFILE ALONG A PATH

ON RAIN INDUCED ATTENUATION
Francesco Fedi, Ugo Merlo, and Piergiorgio Migliorini 1977 8 p ref Presented at the URSI Comm. F Meeting, La Baule, France, 28 Apr. - 6 May 1977
(FUB-1-1977) Avail: NTIS HC A02/MF A01

Results obtained over more than two years from measurements of attenuation (17.8 GHz vertical and horizontal polarization, 11 GHz vertical polarization) and of rainfall intensity carried out simultaneously on the same 9.5 km path in the Fucino area plain are presented. Attention is focused on the effect of the rain rate profile along a path on rain-induced attenuation when data for different polarizations and at different frequencies are compared. Consideration is also given to the rain parameters which may affect the relationship between specific attenuation and rainfall intensity. Author (ESA)

N78-24434# Fondazione Ugo Bordoni, Rome (Italy).
STATISTICAL DATA ON POINT RAINFALL INTENSITY FOR THE DESIGN OF RADIO-RELAY SYSTEMS AT FREQUENCIES ABOVE 10 GHz
Francesco Fedi and Ugo Merlo 1977 8 p refs Presented at the URSI Comm. F Meeting, La Baule, France, 28 Apr. - 6 May 1977
(FUB-2-1977) Avail: NTIS HC A02/MF A01

Experimental results obtained over one year in two Italian localities (Rome and Fucino), about 100 km apart, are reported. The experimental distributions of rainfall intensity are shown together with their log-normal and gamma approximations. Attention is also given to the statistical data properties of the time duration during which the various values of rainfall intensity are exceeded. ESA

N78-24435# Fondazione Ugo Bordoni, Rome (Italy).
CHANNEL MODEL AND EXPERIMENTAL EVALUATION OF ITS PARAMETERS BY DIRECT OBSERVATION OF THE IMPULSE RESPONSE FOR A LINE-OF-SIGHT RADIO LINK
Angelo Bernardini, Guido DiBlasio, P. Mandarini, and Gian Franco Meucci 1977 6 p refs Presented at the URSI Comm. F Meeting, La Baule, France, 28 Apr. - 6 May 1977
(FUB-3-1977) Avail: NTIS HC A02/MF A01

The choice of a suitable channel model for a line-of-sight radio link is considered and a measuring equipment of its parameters is described. Some applications of the measuring system are shown. Author (ESA)

N78-24436# Fondazione Ugo Bordoni, Rome (Italy).
DIGITAL TRANSMISSION OVER ANALOG TERRESTRIAL RADIO-RELAY LINKS USING FREQUENCIES UNDER 10 GHz
Dario DiZenobio, Paolo Mandarini, and Gian Franco Meucci 1977 9 p refs Presented at the EUROCON 77 Meeting, Venice, 3-7 May 1977
(FUB-5-1977) Avail: NTIS HC A02/MF A01

Some topics relative to compatibility of digital (4-DFSK, 34 Mbit/sec) and analog (1800 T.T. channels) radio relay systems in the same band (6 GHz) and route were examined. Starting from the evaluation of the interference noise brought to the analog radio relay systems from the digital one, the transmission power level of digital system was determined in some typical situations; finally, the maximum outage time of digital systems was estimated, the reserve-channel being present or not. Author (ESA)

N78-24437# Fondazione Ugo Bordoni, Rome (Italy).
SUBJECTIVE ASSESSMENTS ELABORATION FOR DETERMINING THE DISTORTION TOLERANCES OF A TELECOMMUNICATION SYSTEM
Salvatore Miceli and Antonio Orlando 1977 7 p refs Presented at the EUROCON 77 Meeting, Venice, 3-7 May 1977
(FUB-6-1977) Avail: NTIS HC A02/MF A01

Subjective tests were performed to estimate the mean opinion of subscribers when picture quality is impaired by various types and levels of distortion. Attention was focused on the estimate of both the mean opinion and its confidence interval, the latter being of importance for evaluating the influence of distortion on picture quality. The relationship between this confidence interval and the sample size was considered, and results on optimum sample design are given. Author (ESA)

N78-24438# Fondazione Ugo Bordoni, Rome (Italy). Centro Onde Millimetriche.
CHARACTERISTICS AND PROSPECTS OF CIRCULAR WAVEGUIDE TELECOMMUNICATION SYSTEMS
Gian Carlo Corazza, Gabriele Falciasecca, Giovanni B. Stracca, and Francesco Valdoni 1977 8 p refs Presented at the EUROCON 77 Meeting, Venice, 3-7 May 1977
(FUB-7-1977) Avail: NTIS HC A02/MF A01

Characteristics of the transmission medium are presented. Those of different systems proposed by France, Great Britain, Japan, and the U.S. are summarized. The possible application of waveguides in telecommunication networks is discussed. ESA

N78-24439# Fondazione Ugo Bordoni, Rome (Italy).
A SUBSCRIBER SIGNALLING SYSTEM FOR DIGITAL TELEPHONE SUBSET
Sergio R. Treves and Francesco Villani 1977 8 p refs Presented at the EUROCON 77 Meeting, Venice, 3-7 May 1977
(FUB-9-1977) Avail: NTIS HC A02/MF A01

With reference to the introduction of telephone digital subsets in local networks, a subscriber digital signal system, suitable for application in subscriber lines between subscriber terminals and local switching exchanges, is presented. Author (ESA)

N78-24440# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
ON THE DETERMINATION OF PROPER MODES IN WAVEGUIDES WITH WALL LOSSES
Erling Dahlberg Feb. 1977 31 p refs
(TRITA-EPP-77-03) Avail: NTIS HC A03/MF A01

Various attempts at determining the proper modes (propagating with exponential attenuation but without change of form) in a straight waveguide with wall losses are discussed. It appears that for a general cross section a stringent treatment would require a quadruple series expansion. For the most usual cross sections, circular and rectangular, valid derivations can, however, be made using simpler means. Earlier, incomplete, treatments seem to have caused several widely accepted misconceptions, some of which are discussed. Detailed calculations for a rectangular guide are given in a companion note. Author (ESA)

N78-24441# Telespazio, S.p.A., Rome (Italy). Telecommunications Development Dept.
DEFINITION STUDY OF A MILLIMETER WAVE EXPERIMENT. VOLUME 1: OPERATIONAL SYSTEM Final Report
Paris ESA Apr. 1977 260 p Partly in ENGLISH, partly in FRENCH 3 Vol.
(Contract ESTEC-2827/76-NLSW)
(ESA-CR(P)-1000-Vol-1) Avail: NTIS HC A12/MF A01

An analysis of future communications traffic was made and proposals discussed for millimeter wave experiments at 20/30 GHz with a view to assessing the usefulness of these wavelengths for successors of the European Communication Satellite. Propagation phenomena at millimeter waves were analyzed: scattering effects, atmospheric attenuation and site diversity, and depolarization. A baseline operational system is defined and a frequency plan is discussed. ESA

N78-24442# Telespazio, S.p.A., Rome (Italy). Telecommunications Development Dept.
DEFINITION STUDY OF A MILLIMETER WAVE EXPERIMENT. VOLUME 2: EXPERIMENTAL SYSTEM Final Report
Paris ESA Apr. 1977 129 p 3 Vol.
(Contract ESTEC-2827/76-NLSW)
(ESA-CR(P)-1000-Vol-2) Avail: NTIS HC A07/MF A01

Proposals for millimeter wave experiments at 20/30 GHz are discussed. An experimental mission payload covering propagation, communication, and transmission experiments is described. Satellite configurations and earth stations related to this mission are also discussed. ESA

N78-24443# Telespazio, S.p.A., Rome (Italy). Telecommunications Development Dept.
DEFINITION STUDY OF A MILLIMETER WAVE EXPERIMENT. VOLUME 3: STUDY SUMMARY Final Report

Paris ESA Apr. 1977 41 p 3 Vol.
(Contract ESTEC-2827/76-NLSW)
(ESA-CR(P)-1000-Vol-3) Avail: NTIS HC A03/MF A01

An analysis of future communications traffic was made and proposals given for millimeter wave experiments at 20/30 GHz with a view to assessing the usefulness of these wavelengths for successors of the European Communications Satellite (Advanced Communications Satellite 1 and 2). The proposals consist of propagation experiments to determine space diversity statistics, digital transmission tests to evaluate disformations, and TDMA tests to demonstrate onboard switching capability and operation in connection with space diversity. An experimental payload configuration is described together with possible ground station support. ESA

N78-24444# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
STUDY OF A MULTIPLEXED DATA BUS FOR SPACE APPLICATION Final Summary Report
B. H. Fritsch Paris ESA Feb. 1977 402 p refs Original contains color illustration
(Contract ESTEC-2297/74-HP)
(ESA-CR(P)-1015) Avail: NTIS HC A18/MF A01

A study was carried out to determine the characteristics and performance of a data bus suitable for the transmission of data onboard spacecraft. In particular, the data bus was intended for the interunit transmission between the different units of the ESA onboard data handling system: a number of remote terminal units, which are slaves of the central terminal unit. The critical parts were examined. Signal coupling on to the bus appears to cause problems, especially if a driver shorts the bus system. A special transformer coupling was investigated to resolve this problem. The realization of high data rates on the bus system requires high power consumption, and the original concept of using CMOS technology had to be reviewed. ESA

N78-24445# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
APPLICATON OF IMPEDANCE BOUNDARY CONDITIONS TO CORRUGATED HORNS
J. E. Hansen and L. Shafai Paris ESA May 1977 28 p refs 4 Vol.
(Contract ESTEC-2866/76-NL-AK(SC))
(TUD-R-187; ESA-CR(P)-1017-Vol-1) Avail: NTIS HC A03/MF A01

Scattering from bodies of revolution with anisotropic surface impedances was formulated. The effect of surface impedance on the formulation is to introduce an additional term for each component of the electrical field when compared with the formulation of the perfectly conducting case. This additional term modifies the elements of the coefficient matrix for the numerical solution of the conducting objects. The application of the method to corrugated feeds is discussed, and the necessary modifications of the coefficient matrix, for this particular case, are presented. Author (ESA)

N78-24446# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
ACCURACY INVESTIGATION OF THE COMPUTER PROGRAMS TSVP2 AND ROT2
Flemming Jensen Paris ESA Sep. 1977 70 p refs 4 Vol.
(Contract ESTEC-2866/76-NL-AK(SC))
(TUD-R-189; ESA-CR(P)-1017-Vol-2) Avail: NTIS HC A04/MF A01

A detailed investigation of the quantitative effects of segmentation and excitation on the accuracy of results obtained by the TSVP2 and the ROT2 computer programs is described. The programs apply the method of moments for solving three-dimensional scattering problems at specific antenna geometries. Effects due to both resonances and numerical convergence were considered. Based on these investigations, guidelines for the application of the two programs are stated. Methods to detect and avoid erroneous results due to internal resonances are suggested. Author (ESA)

N78-24447# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
EXTENSIONS OF THE COMPUTER PROGRAM TSVP2
Flemming Jensen Paris ESA Sep. 1977 20 p refs 4 Vol.
(Contract ESTEC-2866/76-NL-AK(SC))
(TUD-R-190; ESA-CR(P)-1017-Vol-3) Avail: NTIS HC A02/MF A01

The TSVP2 computer program applies the method of moments in solving three-dimensional scattering problems at specific antenna geometries. The extension described covers the computation of condition numbers and internal constraints. The program was modified in order to facilitate the detection and suppression of errors related to internal resonance. A listing of the modified TSVP2 main program and subroutine COOR is presented together with supplementary subroutines and functions. ESA

N78-24448# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
EXTENSIONS OF THE COMPUTER PROGRAM ROT2
Ole Rydhal Paris ESA Sep. 1977 73 p refs 4 Vol.
(Contract ESTEC-2866/76-NL-AK(SC))
(TUD-R-191; ESA-CR(P)-1017-Vol-4) Avail: NTIS HC A04/MF A01

New facilities in the computer program ROT2 are described. The programs applied the method of moments for solving three-dimensional scattering problems at specific antenna geometries. Minor changes were made in the program to reduce the overall run time. A complete listing of the program is given, including modified and new subroutines. ESA

N78-24449# National Technical Information Service, Springfield, Va.
ANTENNA ARRAYS, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, Mar. 1976 - Mar. 1978
William E. Reed Mar. 1978 263 p Supersedes NTIS/PS-77/0262; NTIS/PS-76/0310; NTIS/PS-75/302
(NTIS/PS-78/0310) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09C

The use of antenna arrays in the fields of radar, communications, radio astronomy, navigation, electronic countermeasures, and spacecraft is discussed. Topics include design, antenna radiation patterns, mathematical models, and performance. Phased array studies were excluded. GRA

N78-24450# Computer Sciences Corp., Falls Church, Va.
STUDY OF A RADIO DETERMINATION CAPABILITY FOR INMARSAT, VOLUME 1 Final Report
Sep. 1976 31 p 2 Vol.
(Contract MA-2-4308)
(PB-276962; CSC/TR-76/3017-Vol-1;
MA-RD-930-78-26-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 17B

This study considered the advantages of implementing a radio determination capability for the first generation INMARSAT; developed alternative concepts for this capability; evaluated implementation costs for these alternatives; and provided recommendations for viable methods of implementation. GRA

N78-24451# Computer Sciences Corp., Falls Church, Va.
STUDY OF A RADIO DETERMINATION CAPABILITY FOR INMARSAT, VOLUME 2 Final Report
Sep. 1976 216 p refs 2 Vol.
(Contract MA-2-4308)
(PB-276963; CSC/TR-76-3017-Vol-2;
MA-RD-930-78-27-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 17B

For abstract, see N78-24450.

N78-24452# Washington Univ., Seattle. Dept. of Electrical Engineering.
CALCULATION OF COMPLEX PROPAGATING MODES IN ARBITRARY, PLANE-LAYERED, COMPLEX DIELECTRIC STRUCTURES. 1: ANALYTIC FORMULATION. 2: FORTRAN PROGRAM MODEIG
Robert B. Smith and Gordon L. Mitchell Dec. 1977 301 p refs
(Grant NSF ENG-76-009937)
(PB-277132; UW-TR-206) Avail: NTIS HC A14/MF A01 CSCL 20N

A method is presented for calculating complex eigenmodes of propagation in plane layered structures composed of homogeneous, isotropic materials having arbitrary complex dielectric properties. The formulation was completely general, permitting any number of guiding and nonguiding layers, with loss or gain of each layer. A general complex root searching algorithm was used to calculate the mode eigenvalues. GRA

N78-24164*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VOYAGER FLIGHT PROJECT: DSN TELECOMMUNICATIONS COMPATIBILITY TEST PROGRAM
A. I. Bryan, R. P. Kemp, and B. D. Madsen *In its* The Deep Space Network 15 Dec. 1977 p 13-27 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N78-24165*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING EXTENDED MISSION SUPPORT
T. W. Howe *In its* The Deep Space Network 15 Dec. 1977 p 28-33 (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N78-24168*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VLBI (VERY LONG BASELINE INTERFEROMETRY) INSTRUMENTAL EFFECTS, PART 1
J. W. Layland and W. J. Hurd *In its* The Deep Space Network 15 Dec. 1977 p 54-80 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N78-24171*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPLEX MIXER SYSTEM MODIFICATIONS
G. L. Stevens *In its* The Deep Space Network 15 Dec. 1977 p 88-91 ref (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N78-24172*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MINIMUM-WEIGHT CODEWORDS IN THE (128,64) BCH
L. D. Baumert and L. R. Welch (Univ. of Southern Calif., Los Angeles) *In its* The Deep Space Network 15 Dec. 1977 p 92-94 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N78-24174*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSS 13 AUTOMATED ANTENNA POINTING SUBSYSTEM PHASE 1 HARDWARE
M. W. Sievers *In its* The Deep Space Network 15 Dec. 1977 p 100-109 ref (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N78-24180*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
S-X CONVERSION FOR THE BLOCK 3 RECEIVER--EXCITER
R. E. Weller *In its* The Deep Space Network 15 Dec. 1977 p 141-148 ref (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

N78-24182*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CCIR PAPERS ON TELECOMMUNICATIONS FOR DEEP SPACE RESEARCH
N. F. DeGroot *In its* The Deep Space Network 15 Dec. 1977 p 162-183 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N78-24183*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DUAL COUPLER CONFIGURATION AT DSS 14 FOR THE VOYAGER ERA
T. Y. Otoshi, K. B. Wallace, and R. B. Lyon *In its* The Deep Space Network 15 Dec. 1977 p 184-192 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

N78-24200*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEEP SPACE TELECOMMUNICATIONS AND THE SOLAR CYCLE: A REAPPRAISAL
A. L. Berman *In its* The Deep Space Network 15 Feb. 1978 p 110-124 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 17B

N78-24202*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SYSTEM PERFORMANCE TESTING OF THE DSN RADIO SCIENCE SYSTEM, MARK 3-78
A. L. Berman and J. S. Mehta *In its* The Deep Space Network 15 Feb. 1978 p 129-133 (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 17B

N78-24205*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CCIR PAPERS ON TELECOMMUNICATIONS FOR DEEP SPACE RESEARCH
N. F. DeGroot *In its* The Deep Space Network 15 Feb. 1978 p 164-179 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 17B

N78-24206*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIO FREQUENCY INTERFERENCE BETWEEN SPACECRAFT IN DIFFERENT MISSIONS
N. F. DeGroot *In its* The Deep Space Network 15 Feb. 1978 p 180-184 (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 20N

N78-24210*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EMPIRICAL SPECTRAL BANDWIDTH MODEL FOR SUPERIOR CONJUNCTION
R. S. Rockwell *In its* The Deep Space Network 15 Feb. 1978 p 216-223 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 20N

N78-24219*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN ALTERNATE TECHNIQUE FOR NEAR-SUN RANGING
J. W. Layland *In its* The Deep Space Network 15 Apr. 1978 p 54-62 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 20N

N78-24222*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A METHOD FOR MEASURING GROUP TIME DELAY THROUGH A FEED HORN
T. Y. Otoshi, R. B. Lyon, and M. Franco *In its* The Deep Space Network 15 Apr. 1978 p 82-89 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 20N

N78-24233*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR WIND DENSITY FLUCTUATION AND THE EXPERIMENT TO DETECT GRAVITATIONAL WAVES IN ULTRA-PRECISE DOPPLER DATA
A. L. Berman *In its* The Deep Space Network 15 Apr. 1978 p 189-196 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

N78-24236*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CCIR PAPERS ON TELECOMMUNICATIONS FOR DEEP SPACE RESEARCH
N. F. DeGroot *In its* The Deep Space Network 15 Apr. 1978 p 211-223 (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 17B

N78-24240*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VOYAGER NEAR SIMULTANEOUS RANGING TRANSFERS
G. L. Spradlin *In its* The Deep Space Network 15 Apr. 1978 p 252-259 ref (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 20N

N78-25032# Joint Publications Research Service, Arlington, Va.
POWER AND RADIATING FREQUENCY OF SEMICONDUCTOR TRANSMITTING ANTENNA ARRAYS
G. P. Zemtsov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 36 (JPRS-71139) 18 May 1978 p 12-20 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (Kiev) v. 21, no. 2, 1978 p 96-101 (For availability see N78-25031 15-99)
Copyright. Avail: Issuing Activity

N78-25033# Joint Publications Research Service, Arlington, Va.
FEASIBILITY OF PARAMETRIC STIMULATED EMISSION AND AMPLIFICATION OF ELECTROMAGNETIC WAVES WITH FREQUENCIES HIGHER THAN THAT OF THE PUMPING WAVE, IN ELECTRON FLUXES
A. M. Kalmykov, N. Ya. Kotsarenko, and V. V. Kulish *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., no. 36 (JPRS-71139) 18 May 1978 p 21-24 ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (Kiev), v. 20, no. 10, 1977 p 76-78 (For availability see N78-25031 15-99)
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33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N78-24453 South African Bureau of Standards, Pretoria.
STANDARD SPECIFICATION FOR CARTRIDGE TYPE FUSE-LINKS FOR LOW VOLTAGE ELECTRIC FUSES
Aug. 1977 91 p In ENGLISH and AFRIKAANS
(SABS-172-1977; ISBN-0-626-04413-8) Copyright. Avail: Issuing Activity

This specification covers fuse-links of rated current up to and including 1,250 A, that are suitable for use in ac or dc circuits or both, and of rated voltage not exceeding ac: 1,000 V or dc: 1,500 V. The fuse-links are of the cartridge type in which the fuse-link element (or elements) is (are) enclosed in a ceramic body filled with an arc-extinguishing medium such as finely divided silica. Author

N78-24454 South African Bureau of Standards, Pretoria.
STANDARD SPECIFICATION FOR FUSE-LINK HOLDERS FOR CARTRIDGE TYPE FUSE-LINKS
Aug. 1977 67 p In ENGLISH and AFRIKAANS
(SABS-173-1977; ISBN-0-626-04414-6) Copyright. Avail: Issuing Activity

This specification covers fuse-link holders suitable for the reception of cartridge type fuse-links having a rated current up to and including 800 A, and that are suitable for use in ac or dc circuits or both, of rated voltage not exceeding ac: 1,000 V or dc: 1,500 V. Author

N78-24455 South African Bureau of Standards, Pretoria.
STANDARD SPECIFICATION FOR INTRINSICALLY SAFE ELECTRICAL APPARATUS
Aug. 1977 71 p ref In ENGLISH and AFRIKAANS Revised Supersedes SABS-549-1956
(SABS-549-1977; ISBN-0-626-04418-9; SABS-549-1956) Copyright. Avail: Issuing Activity

Specifications are given covering constructional and electrical requirements for intrinsically safe electrical circuits and apparatus, and their components. Among the tests are temperature rise tests and voltage tests, short circuit, and spark tests. P.R.A.

N78-24456 South African Bureau of Standards, Pretoria.
STANDARD SPECIFICATION FOR LOW-VOLTAGE AIR-BREAK DISCONNECTORS, AIR-BREAK SWITCH-DISCONNECTORS, AND FUSE-COMBINATION UNITS
Nov. 1977 126 p In ENGLISH and AFRIKAANS Revised Supersedes SABS-152-1951
(SABS-152-1977; ISBN-0-626-04473-1; SABS-152-1951) Copyright. Avail: Issuing Activity

This specification covers air-break switches, air-break disconnectors, air-break switch-disconnectors, and fuse-combination units that have thermal current ratings not exceeding 1,600 A and that are intended for use in distribution circuits and motor circuits, the rated voltages of which do not exceed 1,000 ac or 1,200 dc V. Author

N78-24457 South African Bureau of Standards, Pretoria.
STANDARD SPECIFICATION FOR CONTACTORS
24 Aug. 1977 115 p In ENGLISH and AFRIKAANS
(SABS-1092-1977; ISBN-0-626-04401-4) Copyright. Avail: Issuing Activity

This specification covers air-break open-type contactors intended for the closing and opening of electric circuits under the service conditions stated below. The contactors have thermal current ratings up to and including 1,000 A, and the main contacts are intended to be connected to circuits the rated voltage of which does not exceed ac: 1,000 or dc: 1,2000 V. Author

N78-24458*# Hughes Aircraft Co., Culver City, Calif.
TECHNOLOGICAL DEVELOPMENT OF CYLINDRICAL AND FLAT SHAPED HIGH ENERGY DENSITY CAPACITORS Final Technical Report, 22 Apr. 1976 - 15 Sep. 1977
Joseph A. Zelik and Robert D. Parker Dec. 1977 100 p
(Contract NAS3-20090)
(NASA-CR-135286; P77-594) Avail: NTIS HC A05/MF A01 CSCL 09A

Cylindrical wound metallized film capacitors rated 2 micron F 500 VDC that had an energy density greater than 0.3 J/g, and flat flexible metallized film capacitors rated at 2 micron F 500 VDC that had an energy density greater than 0.1 J/g were developed. Polysulfone, polycarbonate, and polyvinylidene fluoride (PVF2) were investigated as dielectrics for the cylindrical units. PVF2 in 6.0 micron m thickness was employed in the final components of both types. Capacitance and dissipation factor measurements were made over the range 25 C to 100 C, and 10 Hz to 10 kHz. No pre-life-test burning was performed, and six of ten cylindrical units survived a 2500 hour AC plus DC lift test. Three of the four failures were infant mortality. All but two of the flat components survived 400 hours. Finished energy densities were 0.104 J/g at 500 V and 0.200 J/g at 700 V, the energy density being limited by the availability of thin PVF2 films. Author

N78-24459*# Colorado State Univ., Fort Collins.
PUNCTURE DISCHARGES IN SURFACE DIELECTRICS AS CONTAMINANT SOURCES IN SPACECRAFT ENVIRONMENTS
E. J. Yadlowsky, R. C. Hazelton, and R. J. Churchill [1978] 25 p refs
(Grant NsG-3145)
(NASA-CR-157105) Avail: NTIS HC A02/MF A01 CSCL 09C

Spacecraft in geosynchronous orbits are known to become charged to large negative potentials during the local midnight region of the satellite orbit. Such discharges have been studied by the electron beam irradiation of dielectric samples in a vacuum environment. In addition to static measurements and photographic examination of the puncture discharges in Teflon samples, the transient characteristics of the electrical discharges are determined from oscillographs of voltage and current and by charged particle measurements employing a biased Faraday cup and a retarding potential analyzer. Using these latter techniques, studies of angular and energy distributions of charged particles have indicated an initial burst of high energy electrons (5 x 10 to the 13th power per discharge at energies greater than 300 eV) followed by a less intense burst of lower energy negative particles. Positive ions are emitted from the discharge site in an initial high velocity burst followed by a lower velocity burst tentatively identified as carbon. Author

N78-24460*# Hughes Aircraft Co., Newport Beach, Calif. Microelectronic Products Div.
SENSING CIRCUITS FOR MULTIWIRE PROPORTIONAL CHAMBERS Final Report, Oct. 1976 - Jan. 1977
H. T. Peterson and E. R. Worley May 1977 64 p
(Contract NAS5-23747)
(NASA-CR-156767) Avail: NTIS HC A04/MF A01 CSCL 09C

Integrated sensing circuits were designed, fabricated, and packaged for use in determining the direction and fluence of ionizing radiation passing through a multiwire proportional chamber. CMOS on sapphire was selected because of its high speed and low power capabilities. The design of the proposed circuits is described and the results of computer simulations are presented. The fabrication processes for the CMOS on sapphire sensing circuits and hybrid substrates are outlined. Several design

options are described and the cost implications of each discussed. To be most effective, each chip should handle not more than 32 inputs, and should be mounted on its own hybrid substrate.
Author

N78-24461*# Ball Bros. Research Corp., Boulder, Colo. Ball Aerospace Systems Div.
ELECTRONIC SWITCHING SPHERICAL ARRAY ANTENNA Final Report, Jun. 1976 - Mar. 1978
Ron Stockton Apr. 1978 160 p
(Contract NAS5-23518)
(NASA-CR-156757; F78-03) Avail: NTIS HC A08/MF A01 CSCL 09C

This work was conducted to demonstrate the performance levels attainable with an ESSA (Electronic Switching Spherical Array) antenna by designing and testing an engineering model. The antenna was designed to satisfy general spacecraft environmental requirements and built to provide electronically commandable beam pointing capability throughout a hemisphere. Constant gain and beam shape throughout large volumetric coverage regions are the principle characteristics. The model is intended to be a prototype of a standard communications and data handling antenna for user scientific spacecraft with the Tracking and Data Relay Satellite System (TDRSS). Some additional testing was conducted to determine the feasibility of an integrated TDRSS and GPS (Global Positioning System) antenna system. Author

N78-24462# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
CONTRIBUTION TO THE DEVELOPMENT OF ION SELECTIVE MINI- AND MACRO-ELECTRODES AND TO THEIR MEASURING TECHNOLOGY Ph.D. Thesis [BEITRAG ZUR ENTWICKLUNG IONENSELEKTIVER MINI- UND MIKRO-ELEKTRODEN UND ZU DEREN MESSTECHNIK]
Michael Oehme 1977 135 p refs In GERMAN
(Diss-5953) Avail: NTIS HC A07/MF A01

Highly selective microelectrodes were developed for measuring calcium ion activity and potassium ion activity in electrophysiological studies. Also described are liquid exchange microelectrodes for determining lithium- and sodium-ions. Minielectrodes with liquid membranes containing ion-selective electrical-neutral ligands were used to determine sodium/potassium activity ratios at acute kidney failure. Transl. by G.G.

N78-24463# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
THE EFFECT OF PUMPING SIGNAL SHAPE ON DEVELOPING MIXED DISTORTIONS IN RESISTIVE FREQUENCY CONVERTERS Ph.D. Thesis [UEBER DEN EINFLUSS DER FORM DES PUMPSIGNALS AUF DIE IN RESISTIVEN FREQUENZUMSETZERN ENTSTEHENDEN MISCHSTOERUNGEN]
Jan Hendrik Fasmer 1977 172 p refs In GERMAN; ENGLISH summary
(Diss-5970) Avail: NTIS HC A08/MF A01

Reduction of frequency conversion distortions are considered which may be produced in resistive mixers. It is shown that the distortions are caused by the terms of order higher than two in the power series expansion of the v/i-relation as seen from the ideal signal sources. The possibility of reducing the distortions by use of a multi-frequency pump signal was studied. By adding subharmonics and/or harmonics of proper phase and magnitude to the pump signal, it is possible to generate such anti-components which reduce the overall distortion between input and output band. This is easily verified with a simplified input/output relation. Author

N78-24464# Honeywell, Inc., St. Petersburg, Fla. Avionics Div.
ATEC DIGITAL ADAPTATION STUDY, DEVELOPMENT AND FIELD EVALUATION: DIGITAL AUTOMATED TECHNICAL CONTROL Final Technical Report, Mar. - Aug. 1977
T. J. Campbell, W. F. Acker, C. L. Christner, D. T. Doyle, and W. M. Goldstein Jan. 1978 233 p refs 3 Vol.
(Contract F30602-75-C-0282)
(AD-A051925; HONEYWELL-1077-14813-Vol-1; RADC-TR-77-431-Vol-1) Avail: NTIS HC A15/MF A01 CSCL 17/2

Subsequent to the completion of the feasibility phase of the ATEC Digital Adaptation Study, existing ATEC hardware and software was adapted or developed to provide Performance Assessment (PA), Fault Isolation (FI) and Trend Analysis for the FKV type digital transmission systems. The resulting DATEC system was then field tested using the facilities of the digital transmission test bed located at Ft. Huachuca, Arizona. The purpose of the field evaluation was to confirm the basic concepts, exercise and test the developed hardware and software, and verify DATEC's capabilities to accomplish PA/FI/TA in the operational environment of an operating digital Transmission system. These DATEC capabilities are directed towards the centralized nodal monitoring of numerous digital transmission links. The DATEC field evaluation confirmed both the practicality and advantages inherent in automated digital system monitoring, insofar as enabling the centrally located controller to performance assess, trend analyze, and fault isolate the digital transmission system for numerous failure occurrences and patterns and system parameter degradation. DATEC enables technicians to monitor in-service system parameters thereby enhancing system performance and allowing more efficient utilization of maintenance resources. Author (GRA)

N78-24465# Honeywell, Inc., St. Petersburg, Fla. Avionics Div.
ATEC DIGITAL ADAPTATION STUDY, DEVELOPMENT AND FIELD EVALUATION: DIGITAL AUTOMATED TECHNICAL CONTROL Final Technical Report, Mar. - Aug. 1977
T. J. Campbell, W. F. Acker, C. L. Christner, D. T. Doyle, and W. M. Goldstein Jan. 1978 315 p refs 3 Vol.
(Contract F30602-75-C-0282)
(AD-A051926; HONEYWELL-1077-14813-Vol-2; RADC-TR-77-431-Vol-2) Avail: NTIS HC A14/MF A01 CSCL 17/2

This section is essentially reproduced from Section 3 of the test report for the Field Test and Evaluation phase of the ATEC Digital Adaptation program. The data taken from the test scenarios has been included with this section to provide a convenient reference. The primary objective of the field tests, as stated in the Statement of Work (S.O.W.) for the ATEC Digital Adaptation Study, was 'to give the DATEC system a detailed shakedown via operational testing so that its feasibility and its potential use in an operational digital system, as typified by the FKV system, could be determined'. In a more explicit manner, the S.O.W. breaks down the primary objective into 23 separate evaluation items. The purpose of Paragraph 6.1 of this section of the test report is to list each of these items (tasks) individually along with substantiating data or other material relating to the topic, not only to more clearly demonstrate compliance with the S.O.W., but also to present in the most straightforward manner the advantages (and disadvantages) of the DATEC system with respect to program requirements. GRA

N78-24466# Honeywell, Inc., St. Petersburg, Fla. Avionics Div.
ATEC DIGITAL ADAPTATION STUDY, DEVELOPMENT AND FIELD EVALUATION: DIGITAL AUTOMATED TECHNICAL CONTROL Final Technical Report, Mar. - Aug. 1977
T. J. Campbell, W. F. Acker, C. L. Christner, D. T. Doyle, and W. M. Goldstein Jan. 1978 167 p 3 Vol.
(Contract F30602-75-C-0282)
(AD-A051927; HONEYWELL-1077-14813-Vol-3; RADC-TR-77-431-Vol-3) Avail: NTIS HC A08/MF A01 CSCL 17/2

The overall conclusion of this report is that the DATEC system successfully completed all requirements of the Statement of Work (S.O.W.). This conclusion is based on the satisfactory adaptation of ATEC hardware and software for digital application as evidenced by test data resulting from execution of the In-Plant Test Plan and Procedures and by the data evaluations presented in Section 2, Field Test Results (Individual Summaries of Tests and Scenarios), and Section 3, Field Test Results Relative to Statement Work Requirements in the Field Test and Evaluation Report. Section 3 of that test report was included in this report (see Section 6), because it addresses S.O.W. compliance directly, and because it provides a complete resume of the field test phase. The specific objective of the field test was the collection of data to demonstrate confirmation of the tasks that are specified

in Paragraph 4.1.12.7 of the Statement of Work. Summarizing those requirements, the field objectives were: (1) gather test data to demonstrate whether the DATEC system satisfied the S.O.W. and system design objectives for PA/FI/TA; (2) perform system level testing to collect data which can be used to evaluate the accuracy, usefulness, and effectiveness of the DATEC system in monitoring a digital transmission link; and (3) make recommendations which will enhance the usefulness and effectiveness of the DATEC system based on field test results. GRA

N78-24467# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Lab.

A NEW LOOK AT THE ROLE OF CIRCUIT DESIGN ON ELECTRON DEVICE RELIABILITY

Keats A. Pullen, Jr. Jan. 1978 32 p refs
(DA Proj. 1L6-62618-AH-80)
(AD-A051196; ARBRL-TR-02038) Avail: NTIS HC A03/MF A01 CSCL 14/4

The effect of circuit design on the reliability of both solid-state and tube-type active devices is considered. A new design approach is presented based on the Ebers-Moll model equations indicating that the proper use of device transconductance can lead to a substantial reduction in circuit voltage with at most a slight reduction in available power output. At the same time, considerably reduced power dissipation and improved device reliability result. Typical problems are examined which show improvements obtained compared to the usual approach to circuit design based on transistor beta characteristics. These detailed examples show the use and benefits of the new design approach as compared to traditional methods. Author (GRA)

N78-24468# Lincoln Lab., Mass. Inst. of Tech., Lexington.

A COMPARISON OF THE USE OF DETERMINISTIC AND RANDOM SIGNALS FOR IMPULSE RESPONSE DETERMINATION

Dennis H. Pruslin 27 Dec. 1977 52 p ref
(Contract F19628-78-C-0002; DA Proj. 8X3-63304-D-215)
(AD-A051321; ESD-TR-77-344; TN-1977-49) Avail: NTIS HC A04/MF A01 CSCL 09/3

A comparison is made between the use of deterministic and random signals for estimating the impulse response of a linear system. It is shown that the two methods are essentially identical, and that in particular, the random signal method has no advantage from the viewpoint of suppressing the effects of uncorrelated interference. Author (GRA)

N78-24469# Northrop Corp., Des Plaines, Ill. Defense Systems Div.

I/J BAND LOW-COST CROSSED-FIELD AMPLIFIER Research and Development Technical Report, 28 Mar. - 28 Sep. 1977

Robert R. Moats 28 Feb. 1978 37 p refs
(Contract DAAB07-77-C-2642)
(AD-A051326; Rept-094-008179; ECOM-77-2642-1) Avail: NTIS HC A03/MF A01 CSCL 09/1

The effort in this program is directed toward the development of an I/J band linear format injected-beam crossed-field amplifier (IBCFA) for electronic warfare, capable of power output of 1000 W peak, 200 W average, between 8.5 and 17 GHz with 20 db gain. A laser-cut shaped-substrate meander line will be used. Performance in an E/F band IBCFA will be evaluated, for which the objective performance is 3.0 kW peak power output, 1.0 kW average power output in the 2-4 GHz band, also with 20 db gain. In addition, a gun for I/J band is to be designed and evaluated. The most important part of this program is the development of technology of the combination of meander line, shaped substrate, and coexpansive ground plane. The shaped substrate concept, including the laser cutting approach, was originated by U.S. Army ERADCOM personnel. The substrate for the meander line is in a ladder configuration. The electrical properties of the ladder substrate with a meander line have been found to be little different from the meander substrate configuration. The substrate material is beryllia ceramic, which is necessary for good thermal conductivity. Laser cutting the substrates for both E/F band and I/J band has met with limited success to date. The breakage rate is still high, especially for I/J band dimensions. GRA

N78-24470# BDM Corp., Albuquerque, N. Mex.

BIBLIOGRAPHY OF BREAKDOWN EFFECTS IN SEMICONDUCTORS Final Report, Mar. - Oct. 1976

G. Neudeck and D. Wiensch Aug. 1977 59 p
(Contract DNA001-76-C-0191)
(AD-A051347; AD-E300014; DNA-4285T) Avail: NTIS HC A04/MF A01 CSCL 20/12

The bibliographies presented in Appendices A and B of the subject report represent a collection of technical documents and articles treating subjects related to conduction processes and failure mechanisms in bipolar semiconductors exposed to high amplitude electrical transients. The sources cited in Appendix B deal more directly with the failure phenomenology involved in the damage. Appendix A is divided into sections treating reverse bias processes and forward bias processes. Each of those sections is divided into parts for articles directly related to the topic, indirectly related to the topic, and peripherally related to the topic. Entries in each part are alphabetized according to the author. Appendix B is divided into sections treating reverse bias failure, forward bias failure, interconnection failure, and general causes of failure. Each section includes separate parts for materials directly, indirectly, or peripherally related to the topic. Entries in each part are alphabetized according to author. Author (GRA)

N78-24471# Varian Associates, Beverly, Mass.

FEASIBILITY REPORT ON MULTIPACTOR SWITCHES

Jan. 1978 35 p refs
(Contract N00173-76-C-0294)
(AD-A051676; VAR-R-45002) Avail: NTIS HC A03/MF A01 CSCL 09/5

The major effort on the program has been to develop a J band multipactor switch centered at 15 GHz. The desired device presents challenges with regard to high impedance circuitry, high secondary emission at low striking potentials, bandwidth, insertion loss, and very small spacing. Mundane challenges with stepped brazing techniques were presented by the use of beryllium and beryllium copper secondary emitters and with processing to maintain secondary emission for good life of the unit. Not all of the challenges were met satisfactorily within the time and funding restrictions, and in fact there are most likely some challenges yet unrecognized. However, much progress has been made in understanding the devices. GRA

N78-24472# Westinghouse Electric Corp., Pittsburgh, Pa.

ADVANCED CURRENT COLLECTION RESEARCH Annual Report for Period Ending 28 Feb. 1977

C. J. Mole, D. L. Green, I. R. McNab, J. L. Johnson, O. S. Taylor, W. R. Gass, and P. K. Lee May 1977 92 p
(Contract N00014-76-C-0683; ARPA Order 3153)
(AD-A052394; Rept-77-8B20-AMCOL-R1) Avail: NTIS HC A05/MF A01 CSCL 09/3

This program is for the research and development of advanced, solid-brush current collection systems for application to innovative electrical machinery. The objectives of the program are to increase the useful lifetime, reduce the sliding contact losses and increase the operating current density of solid brushes operating to transfer current between moving portions of electrical machines. The advances in current collector performance can be utilized to satisfy the requirements for electrical machines of high power density. The report covers the first year of work, during which time a spectrum of brush and slip ring materials were characterized and promising candidate materials selected for in-depth testing. Two, high-speed test rigs were commissioned to extend the brush performance range to anticipated machine speeds. The fundamental aspects of the sliding interface were investigated, and directions of future research established. Fiber brushes were developed and tested to examine the potential of this promising concept. Author (GRA)

N78-24473# Defense Systems Management School, Fort Belvoir, Va.

THE IMPACT OF STANDARD ELECTRONIC MODULES ON FUTURE NAVY ELECTRONIC SYSTEMS DEVELOPMENT

James W. Hugo Nov. 1977 46 p refs
(AD-A052382) Avail: NTIS HC A03/MF A01 CSCL 09/5

The purpose of this study report was to investigate the potential benefits which might be brought about by a more wide-spread use of Standard Electronic Modules (SEM) in the

production of present and future electronic systems. The method of reporting paralleled the method of research. First, the physical and environmental description of SEM was discussed along with a description of the SEM program organization and documentation. Next, a data search and personal interviews were conducted to ascertain the success or failure of some typical operational systems. The present situation was then examined and several different types of SEM implemented systems were examined. In order to investigate the widest possible applications, typical landbased, airborne and shipborne SEM implemented equipments were compared with similar equipments built using conventional designs and custom modules. Comparisons were then made as to life-cycle-cost (LCC), Mean Time Between Failure (MTBF), Mean Time to Repair (MTTR), changes in weight and volume, ease of maintenance, skill levels required for maintenance, logistic support requirements, and initial acquisition cost. GRA

N78-24474# Radio Corp. of America, Lancaster, Pa.
DEVELOPMENT OF A HIGH VOLTAGE AND HIGH CURRENT TRANSCALENT TRANSISTOR Final Technical Report
S. W. Kessler, R. E. Reed, and D. R. Trout Nov. 1977 106 p refs
(Contract DAAK02-72-C-0642)
(AD-A052369) Avail: NTIS HC A06/MF A01 CSCL 09/1

All of the objectives of the contract were obtained or exceeded. An NPN Transcalent transistor was developed which was capable of blocking 800 to 1000 volts and of switching up to 150 amperes. A 500 watts dissipation capability was demonstrated as well as very fast switching times. To achieve these goals, a novel emitter ballast resistor was made a portion of the assembly. This ballast resistor forces current sharing to all areas of the emitter on the transistor chip. The Transcalent transistor uses two heat-pipes as an integral part of the package to cool the silicon transistor chip and its integral ballast resistor. With heat-pipe cooling of the device, it has been demonstrated that 523 watts of heat can be dissipated from the package. A thermal resistance as low as 0.20 C/watt has been observed between the junction and the base of the fins attached to the heat-pipes. The thermal resistance between the junction and 25 C ambient air flowing at 1650 feet per minute was found to be only 0.35 C/watt. The switching speeds of the Transcalent transistor are very fast, less than 1.0 microsecond turn-on time and 2.0 microseconds turn-off time. A large area Safe Operating Curve was determined from the second breakdown, current gain, saturation and sustaining voltage characteristics measured during the contract. Besides the exceptional electrical and thermal characteristics, the Transcalent Transistor provides reductions in size, weight, and ease of installation when compared to other large power transistors and their externally attached heat sinks. GRA

N78-24475# Stanford Univ., Calif. Digital Systems Lab.
INITIAL DESIGN CONSIDERATIONS FOR A HIERARCHICAL IC DESIGN SYSTEM
W. M. VanCleemput and E. A. Slutz Nov. 1977 37 p refs
(Contract N00014-75-C-0601)
(AD-A052367; SU-DSL-TN-132) Avail: NTIS HC A03/MF A01 CSCL 09/5

This paper describes the initial design of a comprehensive hierarchical integrated circuit design system, that is currently being implemented at Stanford University. This system encourages the use of structured hardware design techniques. It is intended for the design and layout of large-scale integrated circuits by means of a combination of manual and algorithmic techniques. Author (GRA)

N78-24476# General Electric Co., Pittsfield, Mass. Ordnance Systems.
ELECTRICAL CHARACTERIZATION OF LINEAR INTEGRATED CIRCUITS Final Technical Report, 1 Jul. 1976 - 30 Jun. 1977
John S. Kulpinski, Jerry Yaple, Richard Paskowsky, Theodore Simonsen, and Herbert Labb Griffiss AFB, N. Y. RADC Feb. 1978 285 p refs
(Contract F30602-76-C-0345)
(AD-A052357; RADC-TR-78-22) Avail: NTIS HC A13/MF A01 CSCL 09/5

This report covers the work performed by General Electric Ordnance Systems pertaining to the electrical characterization of linear integrated circuits. The period of report is July 1976 to June 1977. The effort was divided into three tasks: (1) New electrical characterization, (2) Resolution of problems with existing slash sheets, and (3) Rewrite of preliminary slash sheets. New characterization was performed on five different quad op-amp device types having wide usage in military systems. A slash sheet emanated, once confidence was established in choice of electrical parameters, limits, test circuits and test grouping. Work was begun to characterize quad comparators. The 139 commercial device type was chosen for standardization because of its popularity. Parts were procured and preliminary analysis began. This effort will be completed on a follow-on contract. Extensive evaluation and testing was necessary to resolve the problems that were prevalent on existing slash sheets. The slash sheets in question were /101 (Op-Amps), /102 (volt regulators) /103 (Comparators), /10404 (line receivers) and /108 (transistor arrays). Users/manufacturers were contacted to isolate problems and parts were procured and tested. Data were analyzed and the slash sheets were revised where necessary to allow qualified sources to produce relevant parts. Finally, problems were analyzed for existing slash sheets in much the same way that was applied to preliminary sheets. Lengthy comments submitted by manufacturers and/or users suggested the need for rewrite. After extensive review, /107 (fixed voltage regulators) and /109 (timers) were issued. GRA

N78-24477# Texas Instruments, Inc., Dallas.
IC FABRICATION USING ELECTRON-BEAM TECHNOLOGY Quarterly Report, 1 Mar. - 1 Jun. 1977
Gilbert L. Varnell, Ronald A. Williamson, Terry L. Brewer, John L. Bartelt, Roger A. Robbins, and Claude D. Winborn Jan. 1978 35 p
(Contract DAAB07-76-C-8105)
(AD-A052355; TI-03-77-36; QR-3) Avail: NTIS HC A03/MF A01 CSCL 13/8

Slice processing and process development on the 256 bit bipolar RAMs has continued this quarter. Four lots of bipolar RAMs are presently in process and the oxidation, epitaxial and diffusion parameters from these lots have been measured. A comparison between the measured parameters and their specified values has been made. The processes from polished substrate through DUF O.R. have been significantly modified to reduce cost and processing steps. Work on improving the alignment marker process is continuing. Author (GRA)

N78-24478# Varian Associates, Palo Alto, Calif. Corporate Solid State Lab.
HETEROJUNCTION GATE GaAs FET STUDY Final Report, 23 Aug. 1976 - 23 Aug. 1977
H. Morkoc, S. G. Bandy, R. Sankaran, and G. A. Antypas Oct. 1977 78 p refs
(Contract N00173-76-C-0317)
(AD-A052292) Avail: NTIS HC A05/MF A01 CSCL 09/5

This project is aimed at developing the technology to fabricate A1.5 Ga.5 As gate GaAs FETs with submicron gate dimensions and to compare the dc, large-signal switching and small-signal microwave performance of both normally-on and normally-off devices with similar Schottky-barrier devices. Author (GRA)

N78-24479# BDM Corp., Albuquerque, N. Mex.
SPECIFICATIONS FOR MICROCIRCUIT ELECTRICAL OVERSTRESS TOLERANCE Final Technical Report, Jun. 1976 - Sep. 1977
Robert J. Antinone Griffiss AFB, N. Y. RADC Mar. 1978 153 p refs
(Contract F30602-76-C-0308; AF Proj. 2338)
(AD-A052814; RADC-TR-78-28) Avail: NTIS HC A08/MF A01 CSCL 09/5

The objective of this program is to develop an inexpensive electrical overstress quality assurance sample qualification test to be applied to all future Air Force microcircuit purchases. The maximum ratings presently specified refer only to dc limits and do not reflect the ability of a microcircuit to withstand short duration, high amplitude transients. The new electrical overstress tolerance specification has been developed to provide this information. GRA

N78-24480# Westinghouse Electric Corp., Horseheads, N. Y. Industry and Government Tube Div.

MANUFACTURING METHODS AND ENGINEERING FOR TFT ADDRESSED DISPLAY Quarterly Report, 7 May - 7 Aug. 1977

W. L. Rogers, F. C. Luo, H. Y. Wey, S. D. Burkholder, and M. Green 11 Jan. 1978 25 p

(Contract DAAB07-76-C-0027)

(AD-A052571; Rept-78-8LO-DISPL-P1; QR-5) Avail: NTIS HC A02/MF A01 CSCL 05/8

This is the Fifth Quarterly Report on Contract DAAB07-76-C-0027; Manufacturing Methods and Technology Evaluation for the fabrication of this film transistor based solid state displays. This quarter was one of major accomplishments. First, a substrate was fabricated which was virtually perfect over half the total display area. The primary defect in the inoperable area was identified as open busses due to cracked crossover insulators. As the result of corrective action taken to resolve this problem, the next run produced the excellent half panel. This is not only the best quality display made on the pilot equipment to date, it is comparable in quality to the best displays made on the X-Y equipment. Early indications are that the fabrication of this display is not an isolated event but the beginning of a period of improved production performance. Author (GRA)

N78-24481# Arinc Research Corp., Annapolis, Md.

REVIEW AND ANALYSIS OF TECHNICAL CHARACTERISTICS FOR THE DEFINITIZATION OF SPECIFICATIONS FOR FAMILIES OF OFF-THE-SHELF (OTS) ELECTRONIC TEST EQUIPMENT (ETE)

Larry J. Graham, Albert L. Simmons, and Benjamin F. Paiz Mar. 1978 383 p

(Contract DAEA18-72-A-0005)

(AD-A052424; Rept-1076-01-2-1720) Avail: NTIS HC A17/MF A01 CSCL 14/2

ARINC Research Corporation is under contract to definitize previously developed Off-the-Shelf (OTS) Electronic Test Equipment (ETE) Specifications by converting them into full Military Specifications. The specifications are then to be used by the U.S. Army Communications and Electronics Materiel Readiness Command (CERCOM) in competitive evaluation and procurement of OTS ETE to replace appropriate U.S. Army items of general purpose Test, Measurement, and Diagnostic Equipment (TMDE). This seven-month effort encompasses two basic contract tasks. This report presents the results of Subtasks 2A and 2B of Task 2; Task 1 was reported on in ARINC Publication Number 1076-01-1-1698, December 1977; Subtasks 2C, 2D, and 2E of Task 2 will be reported on separately. The objective of Subtask 2A was to encode and compile in four computer printouts all of the documented technical parameters required to describe the technical characteristics of those OTS ETE Specifications, commercial OTS ETE, and Army inventory TMDE included in the Task 2 TMDE families. As a result of the Subtask 2A efforts, the technical parameters for 9 OTS ETE Specifications, 42 OTS ETE, and 215 Army inventory TMDE were encoded. In Subtask 2B, each technical parameter encoded was reviewed and analyzed to determine the completeness of the OTS ETE Specifications. Appendixes A through J of this report document this process, including the rationale, conclusions, and recommendations applicable to each technical parameter, as well as a summary of the recommendations and the data sources. GRA

N78-24482# TRW Defense and Space Systems Group, Redondo Beach, Calif.

DEFINITION OF THE LINEAR REGION OF X-RAY INDUCED CABLE RESPONSE Topical Report, Jan. - Apr. 1977

Charles E. Wuller, L. Carlisle Neilsen, and David M. Clements 13 May 1977 27 p refs

(Contract DNA001-77-C-0084)

(AD-A052609; AD-E300137; DNA-4405T) Avail: NTIS HC A03/MF A01 CSCL 20/8

Cable response due to X-irradiation is linear with incident fluence provided the deposited charge in cable dielectrics is directly proportional to the X-ray flux. In order to estimate the level at which the linear region ends, we discuss three nonlinear processes which modify the deposited charge profile in a hypothetical cable model: field limiting in vacuum gaps, ionization effects in air gaps, and radiation-induced dielectric conductivity. The exact level, at which limiting of the Norton driver in an elemental length of cable begins, depends on the cable geometry and the X-ray source. Estimates of the onset of nonlinearities due to field limiting and to dielectric conductivity are found in terms of cable and source parameters. With air-filled gaps the Norton driver is always nonlinear. In addition to limiting of the Norton drivers, the load response of a long cable may be limited due to attenuation of propagating currents in the induced conductivity of the bulk of the dielectric. Author (GRA)

N78-24483# New Mexico Univ., Albuquerque. Dept. of Electrical Engineering and Computer Science.

PROFILING OF GaAs USING A DISTRIBUTED RC STRUCTURE Final Report, 1 Jun. - 31 Dec. 1977

Roy A. Colclaser Jan. 1978 23 p refs

(Grant AF-AFOSR-3315-77)

(AD-A052597; EE-251(78)AFOSR-550-1; AFOSR-78-0488TR) Avail: NTIS HC A02/MF A01 CSCL 09/5

The objective of this research was to compare the results of an experiment using a distributed RC structure to evaluate both the impurity profile and mobility of ion-implanted layers in GaAs with the results of the differential Hall-effect technique for the same type of samples. The distributed RC structure experiments were to be performed at The University of New Mexico (UNM) and the differential Hall-effect experiments were to be performed at AFAL-DHR at WPAFB. The theory of the distributed RC technique is presented in the appendix. Author (GRA)

N78-24484# Teledyne MEC, Palo Alto, Calif.

ADVANCED MULTI-MODE TWT Interim Report, 24 Sep. 1976 - 30 Jun. 1977

Louis Lau Mar. 1978 49 p

(Contract F30602-76-C-0406)

(AD-A052716; RADC-TR-78-21) Avail: NTIS HC A03/MF A01 CSCL 09/1

An Advanced Multi-Mode TWT development program is aimed at achieving 5 db pulsed performance in an octave-band traveling-wave tube by operating at a reduced drive level in the CW mode and recovering the loss of basic efficiency through the use of a multiple-stage depressed collector. This report discusses the design, approach and progress during the first nine months of the program. GRA

N78-24485# Physics International Co., San Leandro, Calif.

OWL 2 DIODE STUDY Final Report, Jan. - Apr. 1975

Kendall Childers and Charles Stallings Dec. 1977 65 p refs

(Contract DNA001-75-C-0110)

(AD-A052578; AD-E300149; PIFR-788; DNA-4432F) Avail: NTIS HC A04/MF A01 CSCL 20/7

An experimental program performed on the OWL II pulsed electron beam accelerator with mean electron energy of 950 keV and electron beam energy of 80 kJ has been accomplished. The reliability of the accelerator was shown to be greater than 90 percent at the 90 percent confidence level. The repeatability of the accelerator can be characterized by + or - 4 percent MSD (mean square deviation) of beam energy in the diode, + or - 2 percent MSD of mean electron energy in the diode, and + or - 8 percent MSD of average fluence at target location. Electron beams with areas in excess of 400 sq cm, depths of penetration in excess of 0.6 gm/sq cm and peak doses ranging from 25 to 100 cal/gm were characterized for future thermal structural response testing. Author (GRA)

N78-24486# Perkin-Elmer Corp., Danbury, Conn. Optical Technology Div.

IMAGE SCANNER TECHNOLOGY STUDY Final Report

John S. Montuori Mar. 1978 121 p refs

(Contract DAAK70-77-C-0124)

(AD-A052421; ER-371) Avail: NTIS HC A06/MF A01 CSCL 09/2

This study evaluates available image scanning technologies as they relate to the requirements for providing inputs to digital mapping systems. Author (GRA)

N78-24487# Harris Corp., Melbourne, Fla. Electronic Systems Div.

QA PROCEDURES FOR COMPLEX MICROCIRCUITS Final

Technical Report, Jul. 1976 - Jul. 1977
Louis R. Paradiso and John L. Wolcott Dec. 1977 248 p
(Contract F30602-76-C-0328)
(AD-A052418: RADC-TR-77-418) Avail: NTIS
HC A11/MF A01 CSCL 09/5

The purpose of this study was to establish an alternate procedure in lieu of high magnification preseal visual for complex microcircuits. In-line wafer process controls were developed which provide effective control of the wafer visual conditions. Changes to MIL-STD-883 have been recommended to implement this process control. The study approach was to: perform wafer mapping of visual defect locations; develop in-line wafer process controls from this data; perform preliminary testing with known visual defects on LSI chips to verify alternate test methods; and perform final verification testing on complex LSI wafer product processed in accordance with the recommended procedures. In addition, it was found that a package problem generated numerous bond failures which were not adequately detected by 10 temperature cycles. A change has been recommended to MIL-STD-883 to perform 100 cycles of temperature cycling. Author (GRA)

N78-24488# Power Technologies, Inc., Schenectady, N. Y.
REPORT OF FEASIBILITY OF HIGH PHASE ORDER TRANSMISSION
J. R. Stewart and D. D. Wilson Feb. 1977 112 p refs
(Contract EX-76-C-01-2066)
(CONS/2066-1) Avail: NTIS HC A06/MF A01

Increased power density efficiency of electric utility rights-of-way can be achieved by using a 6-phase configuration instead of the conventional 3-phase method for power transmission. This high phase order (HPO) transmission employs the inherent insulation characteristics of multiphase conductor arrays to increase spatial power transmission efficiency. The broader aspects of the feasibility of HPO transmission analyzed include: electrical properties, mechanical properties, economic factors, and equipment. Tests are recommended to verify and extend analytical results and define the mechanical characteristics of actual HPO structures and conductor arrays. This includes experimental verification of electric field intensities, corona performance, radio interference, audible noise, television interference, and investigation of the electrical breakdown of closely spaced conductors during impulse. ERA

N78-24489# California Univ., Livermore. Lawrence Livermore Lab.
EFFECTS OF PARAMETER ERRORS ON YIELD DETERMINATIONS FROM SHOCK RANGE-TIME DATA. PART 1: THE UNIVERSAL EQUATION
Clifford W. Olsen 7 Jul. 1977 22 p refs
(Contract W-7405-eng-48)
(UCRL-52291-Pt-1) Avail: NTIS HC A02/MF A01

The magnitude of the errors involved in yields determined with SLIFER (shorted location induction from frequency of electrical resonance) data (the most common form of range vs time information) are questioned again and again. A satisfactory answer is seldom possible because of the many interacting parts of the problem. A partial solution is presented here, the effect on calculated yield of a particular change in input can now be estimated. The present approach is completely analytical; noise or other uncertainties associated with real data-acquisition and data-reduction systems are not considered. ERA

N78-24490# Pisa Univ. (Italy). Ist. di Elettrotecnica.
RESISTANCE TO GROSS PERTURBATIONS OF TURBOALTERNATORS WITH DOUBLE PARALLEL EXCITATION [SULLA STABILITA ALLE GROSSE PERTURBAZIONI DI UN TURBOALTERNATORE A DUE VIE DI ECCITAZIONE CONNESSE IN PARALLELO]
Ottorino Bruno and Giancarlo Zini [1977] 10 p refs In ITALIAN Sponsored by CNR
(Rept-1612) Avail: NTIS HC A02/MF A01

The functional behavior of a synchronous isotropic turbogenerator with smooth rotor under appreciable disturbance was studied using a simplified mathematical model with two state variables. The machine considered has a rotor equipped with two separate but coupled parallel magnetic axis winding systems. The characteristic parameters of the machine were deduced. In comparison with the synchronous rotor with a serial winding system, the rotor with parallel winding system has much increased limits of stability to gross perturbations. This increase, which grows with the angle between the two winding systems, reaches an optimum value at 60 electrical deg. ESA

N78-24491# Danish Research Center for Applied Electronics, Hoersholm.
CMOS INTEGRATED CIRCUITS: AN EVALUATION OF 21 VARIANTS OF TYPE 4011 AND 4013 PLASTIC AND CERAMIC ENCAPSULATED CMOS IC'S
Birger Schneider Aug. 1977 51 p refs Sponsored in part by Dan. Council of Technol. and Soc. for Reliability and Environ. Testing
(ECR-73) Avail: NTIS HC A04/MF A01

From 8 manufacturers, 21 CMOC-IC variants were tested under 7 test conditions, each device being tested for 2000 hours. The failures recorded numbered 38, of which 22 are catastrophic, 8 are degradational, and 8 of a temporary nature. Variants were 10 of the 4011A type and 11 of the 4013 A type; 16 were plastic moulded versions and 5 were ceramic encapsulated. The effects of the various tests on the performance, reliability, and transient accessitivity are discussed. Temperature, humidity, and biasing voltages effects are highlighted. ESA

N78-24492# Danish Research Center for Applied Electronics, Hoersholm.
LOW POWER SWITCHES: A QUALITY EVALUATION OF 24 TYPES OF ROTARY WAFER AND PUSH BUTTON SWITCHES
A. Willumsen Oct. 1977 62 p Sponsored in part by Dan. Council of Technol. and Soc. for Reliability and Environ. Testing
(ECR-75) Avail: NTIS HC A04/MF A01

Switches of normal commercial and professional type were evaluated. The environmental and technological test programs are described and results given in tabular form. ESA

N78-24493# Toulouse Univ. (France). Lab. de Genie Electrique.
PIEZO STIMULATED CURRENT (PSC)
Ai Bui, The Giam Hoang, and P. Destruel 1976 2 p Presented at the Intern. Workshop on Thermally Stimulated Processes, Montpellier, France, 22-25 Jun. 1976
Avail: NTIS HC A02/MF A01

The PSC technique for the study of dielectric relaxation phenomenons in solid insulators was compared with the TSC (thermally stimulated current) technique. It is shown that the results obtained with 6 polyamide samples are comparable. ESA

N78-24184*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A HIGH-POWER DUAL-DIRECTIONAL COUPLER
K. B. Wallace and T. Y. Otoshi *In its* The Deep Space Network 15 Dec. 1977 p 193-206 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

N78-24224*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A PROTOTYPE DSN X-S BAND FEED: DSS 13 FIRST APPLICATION STATUS
W. F. Williams *In its* The Deep Space Network 15 Apr. 1978 p 98-103 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 09C

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N78-24494*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEGREE OF VAPORIZATION USING AN AIRBLAST TYPE INJECTOR FOR A PREMIXED-PREVAPORIZED COMBUSTOR

Robert R. Tacina Apr. 1978 12 p refs To be presented at the 1st Intern. Conf. on Liquid Atomization and Spray Systems, Tokyo, 28-31 Aug. 1978; sponsored by the Fuel Soc. of Japan
(Contract EC-77-A-31-1011)
(NASA-TM-78836; E-9546) Avail: NTIS HC A02/MF A01 CSCL 20D

Vaporization data that could be useful in designing premixed-prevaporized fuel preparation systems for gas turbine combustors are presented. The effect of the experimental parameters on vaporization was found to be E = T sub in tau 0.18 (V sub ref + 38) (P sub in + 35)/203000 where E is the degree of vaporization in percent, T sub in the inlet air temperature in K over the range 450 to 700 K, the residence time in ms over the range 4.3 to 23.8 ms, V sub ref the reference velocity in m/s over the range 5 to 22 m/s, and P sub in the inlet pressure in MPa over the range 0.18 to 0.59 MPa. Jet A and Diesel no. 2 fuels were tested for the effect of inlet air temperature and were found to have nearly identical results. Author

N78-24495*# National Aeronautics and Space Administration, Washington, D. C.
STUDIES ON THE INFLUENCE ON FLEXURAL WALL DEFORMATIONS ON THE DEVELOPMENT OF THE FLOW BOUNDARY LAYER
W. Schilz May 1978 11 p refs Transl. into ENGLISH from Acustica (West Germany), v. 15, no. 1, 1956 p 6-10 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75220) Avail: NTIS HC A02/MF A01 CSCL 20D

Flexural wave-like deformations can be used to excite boundary layer waves which in turn lead to the onset of turbulence in the boundary layer. The investigations were performed with flow velocities between 5 m/s and 40 m/s. With four different flexural wave transmissions a frequency range from 0.2 kc/s to 1.5 kc/s and a phase velocity range from 3.5 m/s to 12 m/s was covered. The excitation of boundary layer waves becomes most effective if the phase velocity of the flexural wave coincides with the phase velocity region of unstable boundary layer waves. Author

N78-24496# Council for Scientific and Industrial Research, Pretoria (South Africa). Chemical Engineering Research Group.
FLOW RATE AND PROPERTY-RELATED FLUX FROM POINT MEASUREMENTS IN A DUCT
D. G. Rogers Jul. 1977 14 p refs
(CSIR-CENG-192; ISBN-0-7988-1161-7) Avail: NTIS HC A02/MF A01

The program EMIT was developed to estimate volumetric and property (dust) emission rates for industrial ducts from point velocity and property data. The program was modified to handle laminar in addition to turbulent flow. In the laminar flow case the program differentiates between regular and high aspect ratio ducts. In addition the data input and output procedures were simplified and improved. A major change to the program, now called EMIT2, was the replacement of the surface fitting routine POLFIT with the routine ORTHFT. ORTHFT is reported to be a more efficient routine, and has the advantage of including a data point weight option. This guide contains sufficiently detailed information for the use of EMIT2 without reference to the original user's guide which it supersedes. Author

N78-24497# Douglas Aircraft Co., Inc., Long Beach, Calif.
CALCULATION OF THREE-DIMENSIONAL BOUNDARY LAYERS ON BODIES OF REVOLUTION AT INCIDENCE Final Report, Jan. 1976 - Jan. 1978
Tuncer Cebeci, Richard S. Hirsch, and Kalle Kaups Jan. 1978 75 p refs
(Contract N60921-76-C-0089)
(AD-A051152; MDC-J7643) Avail: NTIS HC A04/MF A01 CSCL 20/4

The laminar three-dimensional boundary layer on a body of revolution at incidence is investigated using two methods. In the first, the standard equations are solved numerically using the Keller box scheme. The second method solves a set of equations, which contain the standard equations, derived from the assumption that crossflow gradients may be important. Since these equations are elliptic in the crossflow plane, an ADI procedure is used for their solution. In regions where there is no crossflow reversal, both methods yield the same results. However, differences appear in regions where the crossflow is not unidirectional. Reasons for this discrepancy are discussed and the relative merits of each procedure identified.
Author (GRA)

N78-24498# New York Univ., N. Y. Dept. of Applied Science.
THE EFFECTS OF ACOUSTICAL DISTURBANCES ON BOUNDARY LAYER TRANSITION Annual Report, 15 Sep. 1975 - 15 Dec. 1977
Gabriel Miller and Andrew Callegari 25 Jan. 1978 44 p refs
(Contract N00014-76-C-0183; NR Proj. 061-232)
(AD-A051497; NYU/DAS-78/01) Avail: NTIS HC A03/MF A01 CSCL 20/4

The analysis of transition from laminar to turbulent flow on a flat plate has been the subject of numerous investigations. In the present work, emphasis has been placed on establishing a computational technique which can be utilized to develop a basic understanding of the effects of the propagation of acoustic waves into a boundary layer, and the ultimate effect of such disturbances on transition. The nonlinear system of unsteady compressible partial differential equations have been solved by a MacCormack predictor-corrector scheme which allows the effect of imposed disturbances to be tracked in time. The question of the mismatch in propagation velocity between Tollmein Schlichting and acoustic waves has been studied. The program indicates that while disturbances are propagating with the speed of sound in the inviscid flow, the waves well within the boundary layer are propagating at a speed on the order of the freestream velocity and thus the boundary layer is being excited by the classical Tollmein Schlichting waves. The analysis thus indicates that the effect of acoustical disturbances on transition is similar to the effect of other perturbations as experiments have indicated.
Author (GRA)

N78-24499# Naval Postgraduate School, Monterey, Calif.
IMPULSIVE FLOW ABOUT A CIRCULAR CYLINDER Interim Report, Mar. 1977 - Mar. 1978
Turgut Sarpkaya Mar. 1978 37 p refs
(Grant NSF ENG-76-24584)
(AD-A051781; NPS-69SL-78-008) Avail: NTIS HC A03/MF A01 CSCL 20/4

The drag and lift forces acting on smooth circular cylinders in an impulsively-started flow have been measured through the use of a vertical water tunnel. The drag and lift coefficients were found to depend on the Reynolds number and the normalized displacement of the fluid from the start. It is recommended that these experiments be extended to higher Reynolds numbers to substantiate further the Reynolds number dependence. Author (GRA)

N78-24500# California Inst. of Tech., Pasadena.
NONLINEAR PROBLEMS IN CONTINUUM MECHANICS Final Report, 1 Jan. 1975 - 31 Dec. 1977
H. B. Keller Jan. 1978 7 p refs
(Contract DAAG29-75-C-0009)
(AD-A051494; ARO-12615.2-M) Avail: NTIS HC A02/MF A01 CSCL 20/4

The main areas of research summarized here were as follows: development and analysis of numerical methods for two-point boundary value problems, for boundary layer flows, and for bifurcation and nonlinear eigenvalue problems; the study of diffusion-reaction systems with particular attention to oscillatory solutions and their bifurcations; the development and testing of a turbulence model, the theory of vortex dynamics. Twenty-seven papers generated by this research are listed. Author (GRA)

N78-24501# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
ON THE SIMULATION OF TRANSONIC SHOCK-TURBULENT BOUNDARY LAYER INTERACTIONS IN CRYOGENIC OR HEAVY GAS WIND TUNNELS
G. R. Inger Apr. 1978 26 p refs Presented at 10th AIAA Aerodynamic Testing Conf., San Diego, 20 Apr. 1978
(Contract N00014-75-C-0456)
(AD-A052830; VPI-AERO-080; Paper-78-808) Avail: NTIS

HC A03/MF A01 CSCL 20/4

The role of the basic similitude parameters governing transonic normal shock-turbulent boundary layer interaction effects in cryogenic wind tunnel tests is studied theoretically for the non-separating case. Besides Mach and Reynolds number, these parameters are the wall to total temperatures ratio, specific heat ratio gamma, viscosity-temperature exponent and Prandtl number. The results show that lack of temperature ratio simulation has a significantly adverse effect on interactive skin friction and hence separation onset compared to the adiabatic free flight case; higher gamma's than air also may have some effect.

Author (GRA)

N78-24502# Purdue Univ., Lafayette, Ind.

APPLICATION OF THE INTEGRATED RAMAN AND LDV SYSTEM Interim Report

S. Lederman Feb. 1978 64 p refs Prepared by Polytechnic Inst. of New York, Farmingdale.

(Contract N00014-75-C-1143; Proj. SQUID; NR Proj. 098-038) (AD-A052690; SQUID-PIB-35-PU) Avail: NTIS HC A04/MF A01 CSCL 20/4

A series of test results concerning a coaxial jet and coaxial turbulent diffusion methane flame are presented. It is shown that the integrated LDV (Laser Doppler Velocimeter) and pulsed Raman technique represent one of the most complete diagnostic systems available. It is capable of providing velocity, turbulence intensity, concentration of species, temperature, concentration and temperature fluctuation, as well as the correlation parameters for chemically reacting turbulent phenomena. All of the above can be obtained simultaneously and nonintrusively.Author (GRA)

N78-24503# Weidlinger Associates, New York.

CORRECTION AND IMPROVEMENT OF THE INERTIAL-DAMPING COLLOCATION APPROXIMATION (IDCA)

F. L. DiMaggio, D. Ranlet, H. H. Leich, and M. L. Baron Jan. 1978 25 p refs

(Contract N00014-02-C-0119)

(AD-A052324) Avail: NTIS HC A02/MF A01 CSCL 20/4

An earlier version of the uncoupling technique referred to as the Inertial-Damping Collocation Approximation is shown to be improperly formulated, and a corrected, improved and simplified version is presented. Author (GRA)

N78-24504# Aeronautical Research Associates of Princeton, Inc., N. J.

RECENT RESULTS OBTAINED IN THE MODELING OF TURBULENT FLOWS BY SECOND-ORDER CLOSURE Interim Report, 1 Jan. - 31 Dec. 1977

Tuido Sandri Feb. 1978 9 p

(Contract F44620-76-C-0048)

(AD-A052415; ARAP-332; AFOSR-78-0680TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

An approximate solution for the tensor scale equation reported previously has been obtained. The solution agrees with both numerical and laboratory experiments for parallel flows. Furthermore, substantial progress has been made towards rational closure of the equations for turbulence mixing and turbulence chemistry. GRA

N78-24505# Oak Ridge National Lab., Tenn.

PIPE INSULATION TESTERS

Stanley H. Jury (Tenn. Univ., Knoxville), David L. McElroy, and J. Peyton Moore 1977 31 p refs Presented at the ASTM Symp. on Heat Transmission Meas., Philadelphia, 19 Sep. 1977

(Contract W-7405-eng-26)

(CONF-770936-1) Avail: NTIS HC A03/MF A01

The steady state temperature distribution of two pipe insulation testers were modeled using the HEATING 5 computer code. One pipe tester, which conformed to the ASTM C335 specification, had the core heater mounted inside a pipe around which the test insulation was placed. Guard heaters were employed to reduce unwanted axial heat conduction. Computer modeling showed that adjustment of the guard heaters was critical for short testers but not for long ones. A second tester, called an ideal tester, had no guard heaters, and only a simple, resistively-heated core heater. The modeling results showed that there is a minimum L/T (length to thickness ratio) that will lead to a correct value of thermal conductivity calculated at the midplane of the tester. A mock-up of the ideal tester was constructed and tested with calcium silicate pipe insulation. Measured values on asbestos-free calcium silicate show reasonable agreement with the data of others which contain asbestos. ERA

N78-24506# Argonne National Lab., Ill.

EFFECT OF TUBE-SUPPORT INTERACTION ON THE DYNAMIC RESPONSES OF HEAT EXCHANGER TUBES

Y. S. Shin, J. A. Jendrzejczyk, and M. W. Wambsganss 1977 15 p refs Presented at the 4th Intern. Conf. on Structural Mech. in Reactor Technol., San Francisco, 15-19 Aug. 1977

(Contract W-31-109-eng-38)

(CONF-770807-51) Avail: NTIS HC A02/MF A01

Operating heat exchangers have experienced tube damages due to excessive flow-induced vibration. The relatively small inherent tube-to-baffle hole clearances associated with manufacturing tolerances in heat exchangers affect the tube vibrational characteristics. In attempting a theoretical analysis, questions arise as to the effects of tube-baffle impacting on dynamic responses. Experiments were performed to determine the effects of tube-baffle impacting in vertical/horizontal tube orientation, and in air/water medium on the vibrational characteristics (resonant frequencies, mode shapes, and damping) and displacement response amplitudes of a seven-span tube model. The tube and support conditions were prototypic, and overall length approximately one-third that of a straight tube segment of the steam generator designed for the CRBR. The test results were compared with the analytical results based on the multispan beam with knife-edge supports. ERA

N78-24507# Argonne National Lab., Ill.

PTA-1 COMPUTER PROGRAM FOR TREATING PRESSURE TRANSIENTS IN HYDRAULIC NETWORKS INCLUDING THE EFFECT OF PIPE PLASTICITY

C. K. Youngdahl and C. A. Kot 1977 20 p refs Presented at the 4th Intern. Conf. on Structural Mech. in Reactor Technol., San Francisco, 15-19 Aug. 1977

(Contract W-31-109-eng-38)

(CONF-770807-55) Avail: NTIS HC A02/MF A01

Pressure pulses in the intermediate sodium system of a liquid-metal-cooled fast breeder reactor, such as may originate from a sodium-water reaction in a steam generator, are propagated through the complex sodium piping network to system components such as the pump and intermediate heat exchanger. To assess the effects of such pulses on continued reliable operation of these components and to contribute to system designs which result in the mitigation of these effects, Pressure Transient Analysis (PTA) computer codes are being developed for accurately computing the transmission of pressure pulses through a complicated fluid transport system, consisting of piping, fittings and junctions, and components. The accuracy of the modeling of pipe plasticity effects on transient propagation was validated using results from two sets of experiments. Validation of PTA-1 using the latter set of experiments is described briefly. ERA

N78-24508# Microtechnica, Turrin (Italy).

DESIGN STUDY OF A LIQUID HEAT TRANSFER LOOP FOR THERMAL CONDITIONING OF SPACELAB EXPERIMENT PAYLOADS Final Report

F. Filippi and A. Arcidiacono Paris ESA 15 Dec. 1977 406 p refs

(Contract ESTEC-2995/76-NL-PP(SC))

(M-RT-598; ESA-CR(P)-1043) Avail: NTIS HC A18/MF A01

A preliminary design for a liquid cooling loop (ECL) to be used for the thermal conditioning of experiment payload onboard Spacelab and other manned spacecraft is presented. Trade-off studies within the scope of the program have led to the definition of a modular ECL having the capability of transferring thermal loads in the range 0 to 4000 W, with temperatures in the range 10 to 60 C and experiment temperature control accuracy + or - 0.5 C to 1 C. The ECL main design features and performances are presented, together with the results of dynamic behavior simulation. The characteristics of the individual ECL modules and of the most important components are defined. Information on availability of suitable, already space qualified hardware, as well as development plans for new components and modules as applicable, are given. Author (ESA)

N78-24509# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering
THE DETERMINATION OF TEMPERATURE HISTORIES IN A CYLINDRICAL RING, HEATED BY CONVECTION
H. F. R. Schoeyer Oct. 1977 101 p refs
(VTH-LR-253) Avail: NTIS HC A06/MF A01

Four different methods are discussed by which graphical solutions for the heat conduction equation in a cylinder wall, heated internally by convection, may be obtained. These are: purely analytic, collocation method, asymptotic expansion, and numerical integration. Fastest results are obtained with asymptotic expansion, which yields reliable results for somewhat larger inner radii. Listings of the computer programs are given. Author (ESA)

N78-24510# European Space Agency, Paris (France).
INVESTIGATION OF THE JET WAKE DISCHARGE FLOW OF A HEAVILY LOADED CENTRIFUGAL COMPRESSOR IMPELLER
Dietrich Eckardt Apr. 1978 216 p refs Transl. into ENGLISH of 'Untersuch. der Strahl/Totwasser-Stroemung hinter einem hochbelasteten Radialverdichterlaufrad', DFVLR, Cologne Report DLR-FB-77-32, 18 Jul. 1977 Original report in GERMAN previously announced as N78-18073 Original German report available from DFVLR, Cologne DM 91.20
(ESA-TT-466; DLR-FB-77-32) Avail: NTIS HC A10/MF A01

The complex flow field in high performance centrifugal compressors was studied. Newly developed measuring techniques for unsteady static and total pressures (based on semiconductor transducers), as well as flow directions (special hot-wire probe), and a digital data analysis system for fluctuating signals (sampling technique) were tested thoroughly. The loss-affected mixing process of the distorted impeller discharge flow was investigated in detail, in the absolute and relative system, at impeller tip speeds up to 380 m/s. A theoretical analysis proved good coincidence of the test results with the Dean-Senoo theory, which was extended to compressible flows. Author (ESA)

N78-24511# Eidgenoessisches Flugzeugwerk, Emmen (Switzerland).
DESIGN STUDY OF AN EXPERIMENT COOLING SYSTEM WITH LIQUID/AIR HEAT EXCHANGER FOR SPACELAB PAYLOADS (ECLA) Final Report
Felix Berner Paris ESA Aug. 1977 158 p refs
(Contract ESTEC-2886/76-NL-PP(SC))
(F+W-FO-1378; ESA-CR(P)-1002) Avail: NTIS HC A08/MF A01

Results are presented of a detailed study of a particular fluid loop which will be used on Spacelab. Its purpose is to control the temperature of experiments by the judicious removal of heat by means of a liquid coolant which circulates in a closed loop and to transfer this heat to the Spacelab's avionics air loop. A modular liquid/air crossflow heat exchanger constitutes the thermal link between coolant and air loops. The control of the heat pump operation for minimum power consumption was investigated, and solutions are given for the case that this control becomes unstable. The optimization of the fluid loop design for selected operating conditions is also dealt with. The conclusion from an integration study is that a fluid loop without heat pump can be mounted in a single module rack but a fluid loop with heat pump must probably be mounted in a double rack on Spacelab if reasonable space is to be available for the payload.
Author (ESA)

N78-24512# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Control Engineering Dept.
IMPROVEMENT OF AN ELECTRICAL HEATER SYSTEM FOR SPACECRAFT THERMAL CONTROL, VOLUME 1 Final Report
K. Marke and H. Klotz Paris ESA Jan. 1978 110 p refs 2 Vol.
(Contract ESTEC-2996/76-NL-PP(SC))
(ESA-CR(P)-1046-Vol-1) Avail: NTIS HC A06/MF A01

For the active temperature control of a mechanical structure with nonhomogeneous and variable heat loads induced by the environment, a control system was defined, which makes use only of heaters as actuators. The control systems under consideration should be able to fulfill high accuracy requirements both for absolute temperature and for the temperature gradient. A mathematical model for the thermal system was defined and a fixed command and a variable command gradient control system were investigated, using different control units. A comparison and trade-off of different controller types was made using results of digital and analog computer simulations. For the proposed control unit, a switching type (PWM) controller, a more detailed analysis is given, as well as a detailed electrical and mechanical design for a breadboard model and for a modular gradient control unit. A general technical specification is given.
Author (ESA)

N78-24513# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Control Engineering Dept.
IMPROVEMENT OF AN ELECTRICAL HEATER SYSTEM FOR SPACECRAFT THERMAL CONTROL, VOLUME 2 Summary of Final Report
K. Marke and H. Klotz Paris ESA Jan. 1978 18 p 2 Vol.
(Contract ESTEC-2996/76-NL-PP(SC))
(ESA-CR(P)-1046-Vol-2) Avail: NTIS HC A02/MF A01

As an example of the system to be controlled an aluminum plate with the dimensions of 1.0 m x 0.5 m x 0.5 mm was selected. Since this system has to be considered as a system with distributed parameters, a discretization of the plate was made by four coupled systems with lumped parameters. The analysis of the thermal system lead to a mathematical 12 node model. This is inherently a nonlinear system because the environmental temperature is coupled by radiation. For control loop synthesis a linearization was necessary. The linearized model is given as an 8th order state space model. Author (ESA)

N78-24514# Nuclear Regulatory Commission, Washington, D. C. Office of Regulatory Research.
PROCEEDINGS OF THE 1977 TWO PHASE FLOW INSTRUMENTATION REVIEW GROUP MEETING
Y. Y. Hsu, ed. Mar. 1978 261 p refs Meeting held at Offices of US NRC, Silver Spring, Md., 13-14 Jan. 1977
(PB-278459; NUREG-0375) Avail: NTIS HC A12/MF A01 CSCL 20D

The progress made on two phase flow instrumentation is reported. The topics discussed are: (1) flow interaction with drag body; use of dispersers, flow modeling for DDT; adaptive cross correlation technique, advanced spool piece development; (2) development of IR-probe, Z-probe, RF-probe, X-ray standard; (3) derivative of constitutive equations, construction test facility and optical probe; (4) use of laser Doppler effect to measure velocity and size distribution of droplets in air water flow; (5) performance of spool piece, turbine model analysis, rake design and pilot tube data, full flow drag screen, transit time study, nuclear hardened densitometer; and (6) survey of calibration facilities. Author

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N78-24515* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NON-DESTRUCTIVE METHOD FOR APPLYING AND REMOVING INSTRUMENTATION ON HELICOPTER ROTOR BLADES Patent
Walt C. Long and Milton L. Williams, inventors (to NASA) Issued 4 Apr. 1978 8 p Filed 19 Apr. 1977 Supersedes N77-22452 (15 - 13, p 1725)
(NASA-Case-LAR-11201-1; US-Patent-4,082,001; US-Patent-Appl-SN-788705; US-Patent-Class-73-756; US-Patent-Class-73-456; US-Patent-Class-416-61; US-Patent-Class-416-144) Avail: US Patent Office CSCL 14B

A nondestructive method of applying and removing instrumentation on airfoils. Official Gazette of the U.S. Patent Office

N78-24516 Materials Research Labs., Melbourne (Australia).
A CRITICAL EVALUATION OF KOCOUR ELECTRONIC THICKNESS TESTORS: MODELS 955 AND S77
B. L. Mourant and L. H. Esmore Jan. 1978 16 p refs
(MRL-TN-409; AR-000-881) Copyright. Avail: Issuing Activity

Factors affecting the accuracy of two models of the Kocour electronic thickness tester were evaluated, including physical measurements of cells and gaskets, determination of the electrical characteristics, and the evaluation of the standard electroplated disks. Constants allowed the instruments to be used for coulometric methods described in ISO, SAA, and BS specifications. Author

N78-24517# National Physical Research Lab., Pretoria (South Africa).
THE ABSOLUTE RADIOMETER AT THE NATIONAL PHYSICAL RESEARCH LABORATORY
Franz Hengstberger 1977 26 p refs
(CSIR-RR-331; ISBN-0-7988-1145-5) Avail: NTIS HC A03/MF A01

The design, operation and instrumental characteristics of an absolute radiometer working on the bolometric principle are described. Among the interesting features of the new absolute radiometer are its ac bridge operation involving phase sensitive detection and its operational capabilities in vacuum and at low temperatures. It can resolve irradiances of about 30 nW/sq cm at room temperature and in air with a power dissipation in the sensors due to the bridge current of only 5 mW. Drift problems due to thermal voltages are avoided without having to resort to chopping of the incident beam, making the new instrument exceptionally easy to operate. Calibrations can be performed in about the same time as is required for comparing lamps with each other on a photometric bench. Author

N78-24518 South African Bureau of Standards, Pretoria.
CODE OF PRACTICE FOR THE PROCESSING, TESTING, AND STORAGE OF SILVER-GELATING MICROFILM FOR ARCHIVAL PURPOSES
9 Nov. 1977 29 p In ENGLISH and AFRIKAANS
(SABS-0141-1977; ISBN-0-626-04478-2) Copyright. Avail: Issuing Activity

The processing, testing, and storage are discussed of first generation microcopies on silver-gelatin type film (in roll, strip, sheet, or card form, mounted or unmounted, and without dimensional limitations) for the preservation of records of permanent value. Author

N78-24519*# ITT Aerospace/Optical Div., Fort Wayne, Ind.
ADVANCED VERY HIGH RESOLUTION RADIOMETER Final Engineering Report, Jan. 1973 - Dec. 1976
[1978] 325 p refs
(Contract NAS5-21900)
(NASA-CR-156764) Avail: NTIS HC A14/MF A01 CSCL 14B

The program covered the design, construction, and test of a Breadboard Model, Engineering Model, Protoflight Model, Mechanical/Structural Model, and a Life Test Model. Special bench test and calibration equipment was also developed for use on the program. Initially, the instrument was to operate from a 906 n.mi. orbit and be thermally isolated from the spacecraft. The Breadboard Model and the Mechanical/Structural Model were designed and built to these requirements. The spacecraft altitude was changed to 450 n.mi., IFOVs and spectral characteristics were modified, and spacecraft interfaces were changed. The final spacecraft design provided a temperature-controlled Instrument Mounting Platform (IMP) to carry the AVHRR and other instruments. The design of the AVHRR was modified to these new requirements and the modifications were incorporated in the Engineering Model. The Protoflight Model and the Flight Models conform to this design. Author

N78-24520# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
ON DETERMINING THE DISTRIBUTION OF ILLUMINATION IN THE INTERIOR OF A PHOTOGRAPHIC LAYER Ph.D. Thesis [ZUR BESTIMMUNG DER VERTEILUNG DER BELICHTUNG IM INNEREN EINER PHOTOGRAPHISCHEN SCHICHT]
Urs Erni 1977 95 p refs In GERMAN; ENGLISH summary
(Diss-5939) Avail: NTIS HC A05/MF A01

Attempts were made to determine the effect of depth, granularity and wavelength of exposure light on the modulation transfer function of photographic emulsion layers. A copy of a grating on the film is used as the diffraction element in a spectrometer. The gratings available did not fulfill the first condition: the ratio d'/d did not have the ideal value of 0.5 (d' = line width, d length of period). For the 2 lp/mm grating, e.g. d'/d was 0.5059 + or - 0.0001. Transfer to the lower layer cannot, however be determined in this manner, since the copy cannot be complementary to the original. To solve the problem it would be necessary to work exclusively in the linear region of the layer and with higher quality originals. The sensitivity of the apparatus could be raised by decreasing the band width and the temperature of the detector. By changing either the wavelength or the direction of light in the diffraction experiment it would be possible to determine the effects on such measurements of the third dimension in the samples. Author

N78-24521# National Physical Research Lab., Pretoria (South Africa). Div. of Applied Spectroscopy.
A SLOTTED QUARTZ TUBE FOR INCREASING SENSITIVITY IN FLAME ATOMIC ABSORPTION ANALYSIS
R. J. Watling and D. J. DeVilliers Aug. 1977 75 p refs
(FIS-108; ISBN-0-7988-1194-3) Avail: NTIS HC A05/MF A01

Results indicate that it is possible to achieve significant increases in analytical sensitivity in atomic absorption analysis for elements such as lead, zinc, cadmium, cobalt, silver, bismuth, manganese, mercury, arsenic, selenium, and antimony by using a slotted quartz tube in conjunction with flame atomization. A corresponding improvement in the precision of absorbance signals at very low element concentration levels is also observed, even for the elements copper, nickel, and iron for which little or no signal enhancement is observed. The slotted quartz tube is used to best advantage when the elements to be analyzed are present in solution at concentrations near the analytical limit. Extensive investigations carried out into tube and slot dimensions are described. It is established that the internal diameter of the tube should be slightly greater than the image of the cathode at the end of the tube, that the entrance slot should be 100 mm long and 2 mm wide, and the exit slot 80 mm long and 2 mm wide. Author

N78-24522# National Physical Research Lab., Pretoria (South Africa).
A NEW MEASURING SYSTEM FOR REALIZING PHOTOMETRIC AND RADIOMETRIC SCALES
Franz Hengstberger, Eberhard Thain, and Richard Turner 1977 33 p refs
(CSIR-RR-332; ISBN-0-7988-1146-3) Avail: NTIS HC A03/MF A01

A project is reviewed for the design and construction of a complete measuring system, capable of forming the basis of South Africa's national measuring scale in the fields of light and optical radiation measurement. The nucleus of this system was a new absolute radiometer. In order to cope effectively with the different tasks to be performed, the measuring system consisted of two independent subsystems, each of which was based on the same type of plug-in detector module. Filter holders, shutter modules, detector modules, and various other attachments were completely interchangeable between the two subsystems. One of these was designed for maximum flexibility and was built up on an optical bench. Author

N78-24523# National Physical Research Lab., Pretoria (South Africa).
A FRESH LOOK AT THE LEAD-HEATING EFFECT IN ABSOLUTE RADIOMETRY
Franz Hengstberger 1977 87 p
(CSIR-RR-333; ISBN-0-7988-1147-1) Avail: NTIS HC A05/MF A01

A review is given of the historical emergence of correction

experiments for the lead-heating effect in absolute radiometry. Various possible versions of a method are discussed and analyzed within the framework of a theory of the instrumental corrections for absolute radiometers. The influence of the responsivity characteristics of the instruments, as postulated in this theory, is demonstrated by means of an extensive analysis of data obtained with an absolute radiometer. The FORTRAN program used for the data analysis is listed and results are presented both in tabular and in graphical form. Author

N78-24524# Comstock and Wescott, Inc., Cambridge, Mass.
DOUBLE NORMAL-INCIDENCE ULTRAVIOLET GRATING SPECTROMETER Final Report, 21 May 1975 - 30 Sep. 1977
Joseph P. Padur Hanscom AFB, Mass. AFGL 30 Nov. 1977 74 p
(Contract F19628-75-C-0198; AF Proj. 6688)
(AD-A051432; AFGL-TR-77-0273) Avail: NTIS HC A04/MF A01 CSCL 17/5

This report describes the design, development, and fabrication of a double normal incidence ultraviolet grating spectrometer for sounding rockets and the field services supporting its launch. Author (GRA)

N78-24525# Harris Corp., Melbourne, Fla. Electro-Optics Dept.
MICRO-REDUCTION AND ENLARGEMENT OF GRAPHIC INFORMATION STUDY, MEGIS Final Technical Report, Mar. 1975 - Dec. 1977
R. G. Zech, L. M. Ralston, B. R. Reddersen, and H. Roberts Dec. 1977 403 p refs
(Contract DAAG53-75-C-0155)
(AD-A051532; HESD/EOD-1624-F; ETL-0063) Avail: NTIS HC A18/MF A01 CSCL 14/5

The microreduction and enlargement of high-resolution graphic data such as map separations was investigated. Original graphics were photoreduced to 70 mm film transparencies and stored as 20 x 20 mm phase-randomized Fourier-transform holograms. Experimental data show that enlargement to full size produces only minimal distortion. Image brightness and brightness uniformity were adequate for reproduction. However, resolution and line quality did not meet current standards for cartographic production. Holography is judged to be a promising approach to high-density microstorage only if several fundamental problems can be solved. Author (GRA)

N78-24526# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
LOW COST LASER GYRO, PHASE 1 Final Report
F. Aronowitz and Joseph S. Killpatrick 1978 25 p
(Contract DAAK40-77-C-0130)
(AD-A051675; TR-1) Avail: NTIS HC A02/MF A01 CSCL 20/5

The contract was a design study to determine an optimum ring laser gyro size to be used for Army missile applications. As a result of the study, the details of which are presented in this document, a 20 cm path length laser gyro is recommended. The gyro will be operated with the infra-red transition. The lock-in compensation technique will be an alternating bias obtained by use of the transverse Kerr magneto-optic effect at one of the (magnetic) mirrors. GRA

N78-24527# Brown Boveri Research Center, Baden (Switzerland).
QUANTITATIVE STRAIN AND STRESS DETERMINATION FROM HOLOGRAPHIC INTERFEROGRAMS Final Technical Report, 31 Jan. - Sep. 1977
R. Dandliker, B. Ineichen, B. Eliasson, and J. Mastner Sep. 1977 50 p refs
(Grant DA-ERO-76-G-059)
(AD-A048640) Avail: NTIS HC A03/MF A01 CSCL 11/6

The basic problems of quantitative determination of mechanical strain through holographic interferometry are discussed. A solution based on the calculation of local derivatives of the holographically recorded surface displacements is described. This method uses essentially heterodyne holographic interferometry for the quantitative determination of the surface displacement from the fringe pattern in the image plane. With this technique the interference phase can be measured with an accuracy and reproducibility of + or - 0.3 deg at any point in the fringe pattern, corresponding to an interpolation of better than .001 of one fringe. Numerical examples are given for the sensitivity and accuracy of surface strain measurements and the determination of bending and torsion. Experimental results for bending and torsion of arbitrarily curved and twisted space beams, such as turbine blades, are reported. Accuracy and agreement with theory are within a few percent. Author (GRA)

N78-24528*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROCEEDINGS OF THE 8TH PRECISE TIME AND TIME INTERVAL (PTTI) APPLICATIONS AND PLANNING MEETING
1977 762 p refs Meeting held at Washington, D. C., 30 Nov. - 2 Dec. 1976 Prepared in cooperation with NRL
(NASA-TM-79451; AD-A043856; X-814-77-149) Avail: NTIS HC A99/MF A01 CSCL 14B

The Proceedings contain the papers presented at the Eight Annual Precise Time and Tme Interval PTTI Applications and Planning Meeting. The edited record of the discussions following the papers and the panel discussions are also included. This meeting provided a forum for the exchange of information on precise time and frequency technology among members of the scientific community and persons with program applications. The 282 registered attendees came from various U.S. Government agencies, private industry, universities and a number of foreign countries were represented. In this meeting, papers were presented that emphasized: (1) definitions and international regulations of precise time sources and users, (2) the scientific foundations of Hydrogen Maser standards, the current developments in this field and the application experience, and (3) how to measure the stability performance properties of precise standards. As in the previous meetings, update and new papers were presented on system applications with past, present and future requirements identified. Author (GRA)

N78-24529# SRI International Corp., Menlo Park, Calif.
PHOTOGRAPHIC IMAGE ENHANCEMENT USING CHEMILUMINESCENT AND FLUORESCENT LIGHT Final Report, 1 Oct. 1976 - 30 Sep. 1977
C. Leung, R. G. Manning, R. R. Pettijohn, and Z. Reyes 30 Nov. 1977 52 p refs
(Contract N00014-76-C-1115)
(AD-A052539) Avail: NTIS HC A04/MF A01 CSCL 14/5

The goal of this research program was to develop methods analogous to autoradiographic photographic image enhancement in which light instead of nuclear radiation is emitted from the photographic image. These methods would allow images to be intensified without the inconvenience and limitations that result from the currently required radionuclides. Fluorescence and chemiluminescence methods suitable for photographic image enhancement have been investigated, and the feasibility of both approaches has been demonstrated. Fluorescent images were obtained by chemically reacting UV-fluorescent dyes with silver bromide or silver iodide bleached images. Fluorescence quenching after reaction has been solved by transfer of the dye image to pretreated plastic. Chemiluminescent images were obtained by copper (II) catalyzed oxidation of luminol at or near the site of the original image silver grain. The original negative was either toned to copper sulfide or physically developed to deposit a thin layer of metallic copper on the image silver grains. GRA

N78-24530# Los Alamos Scientific Lab., N. Mex.
POSITION-SENSITIVE GAS PROPORTIONAL CHAMBERS
C. L. Morris, G. W. Hoffmann, and H. A. Thiessen 1977 4 p refs Presented at the Nucl. Sci. Symp., San Francisco, 19 Oct. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2438) Avail: NTIS HC A02/MF A01

A number of multiwire, position-sensitive, gas proportional chambers was constructed which use fast delay line (2.5 ns/cm) readouts to provide trajectory position and angle information for particles near the focal planes of the Energetic Pion Channel and Spectrometer (EPICS) and High Resolution Spectrometer (HRS). These chambers are two dimensional with anode wires in one direction and cathode wires in the other direction. When

operated as ordinary delay line chambers, position resolution of 0.5 mm (FWHM) can be obtained in the cathode direction for short cathode wire lengths. If the drift information from the anodes is used, resolution of less than 0.35 mm (FWHM) can be obtained in this direction. The chambers can be operated at count rates of 500,000 pulses/sec with live times of greater than 90 percent. Efficiencies, measured at lower counting rates, are typically greater than 99 percent. ERA

N78-24531# European Space Agency, Paris (France).
DESIGN AND CALIBRATION OF 5-POINT CONICAL PRESSURE PROBES FOR MEASURING IN SUPERSONIC FLOW
Hans-Gerd Neuhaeuser and Dieter Coors Apr. 1978 54 p refs Transl. into ENGLISH of 'Entwurf u. Eichung von 5-Loch-Kegelsonden fuer Messungen in Ueberschallstroemungen', Tech. Hochschule Aachen Report DLR-FB-77-28, 27 Jun. 1977 Original report in GERMAN previously announced as N78-18015 Original German report available from DFVLR, Cologne DM 21.40
(ESA-TT-464; DLR-FB-77-28) Avail: NTIS HC A04/MF A01

A survey is given on design and calibration of a 5 point conical pressure probe for measuring flow angle, Mach-number, static pressure, and total pressure. The pressures measured at the boreholes of the probe are combined to give nondimensional expressions. The determination of the single flow parameters results from the calculation of polynomials the coefficients of which are determined according to the calibration data by means of least squares criteria. The accuracy of the calibration is demonstrated by comparing the measurement of a flow angle in the flow area of a cone and of a double cone, respectively, with theoretical data. Possibilities of improving the instrument quality by corrections to the evaluations are discussed. Author (ESA)

N78-24532# National Bureau of Standards, Washington, D. C.
STANDARD REFERENCE MATERIALS: STANDARD THERMOCOUPLE MATERIAL, PART-67, SRM-1967
Robert L. Powell, Larry L. Sparks, and G. Hust Feb. 1978 52 p refs
(NBS Proj. 2750295)
(PB-277172; NBS-Spec-Pub-260-56) Avail: NTIS HC A04/MF A01 CSCL 14B

Thermoelectric voltages, residual resistance ratios, temperature coefficients of resistance, and chemical composition were reported for a high purity, highly characterized lot of platinum that was developed as a thermoelectric standard, Pt-67. A review of the historical development of the material is followed by characterization data on the material and descriptions of the cryogenic and high temperature apparatus. Effects of impurities are also described. GRA

N78-24169*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VLBI CLOCK SYNC AND THE EARTH'S ROTATIONAL INSTABILITY
A. W. Layland and A. N. Mathews *In its* The Deep Space Network 15 Dec. 1977 p 81-84 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

N78-24175*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
DIGITAL HIGH DENSITY (80 Mb/s) TAPE
M. D. Donner *In its* The Deep Space Network 15 Dec. 1977 p 110-118 (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 14E

N78-24195*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FREQUENCY SELECTION AND CALIBRATION OF A WATER VAPOR RADIOMETER
S. C. Wu *In its* The Deep Space Network 15 Feb. 1978 p 67-81 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 14B

N78-24197*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRELIMINARY DESIGN WORK ON A DSN VLBI CORRELATOR
W. A. Lushbaugh and J. W. Layland *In its* The Deep Space Network 15 Feb. 1978 p 90-98 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 14B

N78-24220*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE TONE GENERATOR AND PHASE CALIBRATION IN VLBI MEASUREMENTS
J. B. Thomas *In its* The Deep Space Network 15 Apr. 1978 p 63-74 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 14B

N78-24242*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A NEW, NEARLY FREE, CLOCK SYNCHRONIZATION TECHNIQUE
W. H. Hietzke *In its* The Deep Space Network 15 Apr. 1978 p 268-272 (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 14B

N78-25040# Joint Publications Research Service, Arlington, Va.
ADVANCES IN THE MECHANICS OF GYROSCOPIC AND INERTIAL SYSTEMS
N. V. Butenin and D. M. Klimov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 30 (JPRS-70714) 2 Mar. 1978 p 32-56 Transl. into ENGLISH from Izv. Vyssh Ucheb. Zaved., Priborostr. (Leningrad), v. 20, no. 10, 1977 p 79-96 (For availability see N78-25037 15-99)
Copyright. Avail: NTIS HC A06/MF A01

N78-25041# Joint Publications Research Service, Arlington, Va.
PROBLEMS OF THE DEVELOPMENT OF CLOCKS
Z. M. Akselrod, N. V. Butenin, and B. M. Chernyagin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 30 (JPRS-70714) 2 Mar. 1978 p 57-63 Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 20, no. 10, 1977 p 97-103 (For availability see N78-25037 15-99)
Copyright. Avail: NTIS HC A06/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N78-24533# Rochester Univ., N. Y.
THEORETICAL ASPECTS OF LASER RADIATION AND ITS INTERACTION WITH ATOMIC AND MOLECULAR SYSTEMS
Thomas F. George 1977 55 p Presented at Workshop, Rochester Univ., N. Y., 3-5 Jun. 1977
(Grant NSF CHE-77-14548)
Avail: NTIS HC A04/MF A01

Progress and research opportunities perceived in the theory of the interaction of laser radiation with atomic and molecular systems, and in the theory of the production of this radiation itself, i.e., excitation of the laser medium and laser operation are reviewed. Emphasis is placed on spectroscopy, collision dynamics, and laser operation. Author

N78-24534# Avco-Everett Research Lab., Everett, Mass.
ONE METER KrF LASER SYSTEM Semiannual Report, 23 Feb. - 22 Aug. 1977
J. C. Hsia, J. H. Jacob, J. A. Mangano, and M. Rokni 22 Aug. 1977 109 p refs
(Contracts N00014-76-C-1032; DARPA Order 3125)
(AD-A051534) Avail: NTIS HC A06/MF A01 CSCL 20/5

This interim report covers research directed towards efficient high power UV/visible lasers. The key issues being addressed are: (1) e-beam and e-beam controlled discharge excitation, (2) laser kinetics and modeling, (3) discharge stability and enhancement, (4) laser medium gain, adsorption and energy extraction and (5) intrinsic laser efficiency and scaling. Using e-beam controlled discharge pumping of a one meter KrF laser, 75 joules of laser output were obtained with 10% intrinsic efficiency at a specific energy of 10 J/liter. The use of an externally applied magnetic field to guide the e-beam is shown to effectively prevent e-beam steering by the discharge current and thus allow this excitation technique to be scaled to large

laser apertures and very large single pulse energies. For efficient discharge pumping spatial e-beam energy deposition uniformity is shown to be important and methods of improving the deposition uniformity are proposed. Using pure e-beam excitation of XeF, a laser output of 36 joules was obtained with 2.6% intrinsic efficiency at a specific energy of 8 J/liter. Processes limiting XeF laser efficiency are identified and remedies proposed. Author (GRA)

N78-24535# Naval Research Lab., Washington, D. C. Plasma Physics Div.

ABSORPTION OF LASER LIGHT IN LASER FUSION PLASMAS Interim Report

B. H. Ripin Dec. 1977 34 p

(AD-A051302; AD-E000118; NRL-MR-3684) Avail: NTIS HC A04/MF A01 CSCL 18/1

Variables affecting the absorption of high-irradiance (10 to the 15th power to 10 to the 16th power W/sq cm) laser light in plasmas were studied experimentally and where possible related to theory. It was found that temporally structured laser pulses, simulating those required in many pellet implosion designs, exhibit very enhanced backscatter consistent with Brillouin. The variation of absorption with focal position and incident irradiance, and the critical surface structure inferred from scattered laser light will be described and their implications to laser fusion discussed. Author (GRA)

N78-24536# California Univ., Berkeley. Dept. of Chemistry.

CHEMICAL LASERS AND LASER-INDUCED KINETIC PROCESSES Final Report, 1 Oct. 1974 - 30 Sep. 1977

George C. Pimental 30 Sep. 1977 22 p refs

(Grant AF-AFOSR-2616-74)

(AD-A051063; AFOSR-78-0207TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

The 'Tandem Laser' and 'Zero Gain' methods (developed in these laboratories) to study the primative vibrational populations obtained in selected chemical reactions have been exploited. The NH-fluoromethane insertion-elimination reactions were carefully examined as a prototype example of this type of chemical laser. GRA

N78-24537# Defence Research Establishment Valcartier (Quebec).

SIMULTANEOUS FREQUENCY STABILIZATION AND INJECTION IN A TEA-CO2 OSCILLATOR

J. L. Lachambre Jan. 1978 14 p refs

(AD-A049929; DREV-R-4088/78) Avail: NTIS HC A02/MF A01 CSCL 20/5

A novel technique that uses a single master oscillator to serve both the injection and the stabilization function in a TEA-CO2 laser transmitter is described. The method, based on a two polarization scheme, provides sufficient optical isolation between the TEA laser pulse and the probing laser beam to prevent any damage or saturation of the controlling system. Reproducible and stable SLM operation in the MW power levels are achieved on a long-term basis. Author (GRA)

N78-24538# California Univ., Santa Barbara. Quantum Inst.

DEVELOPMENTAL STUDIES OF POTENTIAL CHEMICALLY PUMPED ELECTRONIC TRANSITION LASERS: COMBUSTION OF ALKALINE EARTHS IN NITROUS OXIDE-CARBON MONOXIDE AND REACTIONS OF METASTABLE ALKALINE EARTH ATOMS Final Scientific Report, 15 Oct. 1975 - 14 Oct. 1977

David J. Benard, Warren D. Slafer, and Paul H. Lee 10 Mar. 1978 18 p refs

(Grant AF-AFOSR-2959-76)

(AD-A052410; AFOSR-78-0693TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

Alkaline earth catalyzed N2O-CO flames have been studied as potential electronic transition chemical lasers. The addition of CO to the M=N2O flames, where M=Mg, Ca, and Sr, have been shown to efficiently produce the respective metastable alkaline earth (^3P) atoms. These flames have been further shown to exhibit enhanced MO(A yields X) photon yields as well as new MO band systems in the chemiluminescence spectra. The mechanism of these reactions has been elucidated and information has been gained regarding the identity of the reservoir state. Results of spectroscopic assignments and gain measurements on the alkaline earth oxide bands are reported as are results of transfer and excimer formation studies. Author (GRA)

N78-24539# Sandia Labs., Albuquerque, N. Mex.

PERFORMANCE CHARACTERISTICS OF THE SANDIA ATOMIC IODINE LASER (SAIL-1)

T. D. Padrick, R. E. Palmer, M. A. Palmer, and M. E. Riley 1977 4 p refs Presented at Conf. on Laser Eng. and Appl., Washington, D. C., 1 Jun. 1977

(Contract EY-76-C-04-0789)

(SAND-76-9300; Conf-770629-2) Avail: NTIS HC A02/MF A01

An atomic iodine laser was evaluated as a candidate for laser fusion applications. Oscillator performance and reliability, temporal pulse distortion, and beam quality of amplified pulses, energy extraction efficiency and overall efficiency are discussed. ERA

N78-24540# Johns Hopkins Univ., Baltimore, Md. Dept. of Chemistry.

FAR INFRARED CHEMICAL LASERS Technical Progress Report, 1 Aug. 1976 - 31 Jul. 1977

D. W. Robinson Aug. 1977 8 p

(Contract EY-76-S-02-2523)

(COO-2523-11; TPR-3) Avail: NTIS HC A02/MF A01

Laser oscillation at 337 and 311 micron were obtained from HCN molecules prepared in vibrationally excited states by the reaction between cyanogen radicals and hydrogen molecules. It was observed in HCN raised to an electronically excited state by flash photolysis. The characteristics of the pulsed output quite different in the two cases and beginnings were made on experiments to probe the pumping and energy transfer kinetics. ERA

N78-24541# Addis Translations International, Portola Valley, Calif.

THEORETICAL ANALYSIS OF LASERS UTILIZING THE VIBRATIONAL-ROTATIONAL TRANSITION OF MOLECULAR HYDROGEN AND ITS ISOTOPES

N. G. Basov, N. Ye. Vtorova, A. N. Lobanov, A. N. Orayevskii, and A. F. Suchkov 1977 31 p refs Transl. into ENGLISH from preprint 47

(UCRL-Trans-11263) Avail: NTIS HC A03/MF A01

The rates of excitation of various levels of H2 molecules and the energy balance of electrons in hydrogen and its mixtures with helium were calculated over a broad range of change of the parameter E/N on the basis of numerical solution of the kinetic equation for the electron distribution function. Modes of coherent and noncoherent amplification in H2 and HD were studied, possible values of efficiency and specific power yield were estimated. A sample of the active medium of a laser was studied using its own radiation. The values of breakdown fluxes were calculated as functions of the composition of the mixture, radiation pulse length and gas pressure. ERA

N78-24542# Addis Translations International, Portola Valley, Calif.

HIGH-PRESSURE GAS LASERS USING MOLECULAR ELECTRON TRANSITIONS

N. G. Basov, A. N. Brunin, S. G. Burdin, V. A. Danilychev, A. G. Degtyarev, O. M. Kerinov, A. N. Lobanov, and A. F. Suchkov 1977 70 p refs Transl. into ENGLISH from preprint 23

(UCRL-Trans-11265) Avail: NTIS HC A04/MF A01

The use as laser medium of a mixture of rare gases with other gases made it possible to broaden the spectrum of available lasing lines. Energy transfer from excited atoms, molecules and molecular ions of inert gases to the molecules of an impurity gas made it possible to obtain lasing with a high efficiency in the ultraviolet and visible. Results of experiments dealing with spontaneous and laser emission of compressed inert gases and their mixtures with other gases excited by a powerful electron beam are presented. ERA

N78-24543# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

CURRENT LIMITATION BY AN ELECTRIC DOUBLE LAYER IN ION LASER DISCHARGES

S. Torven Dec. 1977 9 p refs Submitted for publication (TRITA-EPP-77-26) Avail: NTIS HC A02/MF A01

A theory for current limitation in ion laser discharges was investigated. The basic mechanism considered is saturation of the positive ion flux at an electric double layer by the limited flux of neutral atoms. The result is compared with a recently published synthesis of a large number of experimental data which agree well with those predicted by the double layer model. Author (ESA)

N78-24170*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
X- AND K-BAND MASER DEVELOPMENT: EFFECTS OF INTERFERING SIGNALS
R. C. Clauss *In its* The Deep Space Network 15 Dec. 1977 p 85-87 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 20E

N78-25036# Joint Publications Research Service, Arlington, Va.
SOVIET LASER IMPROVEMENTS DISCUSSED
O. Gusev *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 36 (JPRS-71139) 18 May 1978 p 41-42 Transl. into ENGLISH from Pravda (Moscow), 20 Apr. 1978 p 6 (For availability see N78-25031 15-99)
Avail: Issuing Activity

N78-25039# Joint Publications Research Service, Arlington, Va.
POWERFUL LASER IS BEING TESTED
V. Andriyakhin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 30 (JPRS-70714) 2 Mar. 1978 p 24-31 refs Transl. into ENGLISH from Nauka i Zhizn (Moscow), no. 11, 1977 p 86-90 (For availability see N78-25037 15-99) Copyright. Avail: NTIS HC A06/MF A01

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N78-24544* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
STATOR ROTOR TOOLS Patent
Donald D. Diamond, inventor (to NASA) (Serv-Air, Inc., Houston, Tex.) Issued 14 Mar. 1978 6 p Filed 8 Nov. 1976 Supersedes N77-13062 (15 - 04, p 0426) Sponsored by NASA
(NASA-Case-MSC-16000-1; US-Patent-4,078,290; US-Patent-Appl-SN-739915; US-Patent-Class-29-252; US-Patent-Class-29-244; US-Patent-Class-29-23.5; US-Patent-Class-29-156.8R) Avail: US Patent Office CSCL 13I

An apparatus and method for removing and reinserting base member segments in an arcuate slot in an engine part are described. Each base member separately includes blades or stators, holding the engine part in place while manipulating fingers or an arm onto an interfitting abutting relationship with most of the blades. A torque force is applied to the base of the blades to move a base member relative to such an arcuate slot. Official Gazette of the U.S. Patent Office

N78-24545* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AUTOMOTIVE GAS TURBINE FUEL CONTROL Patent
Harold Gold, inventor (to NASA) Issued 14 Mar. 1978 14 p Filed 8 Nov. 1976 Supersedes N77-13426 (15 - 04, p 0477)
(NASA-Case-LEW-12785-1; US-Patent-4,078,378; US-Patent-Appl-SN-739909; US-Patent-Class-60-39.28R) Avail: US Patent Office CSCL 21A

A fuel control system is reported for automotive-type gas turbines and particulary advanced gas turbines utilizing variable geometry components to improve mileage and reduce pollution emission. The fuel control system compensates for fuel density variations, inlet temperature variations, turbine vane actuation, acceleration, and turbine braking. These parameters are utilized to control various orifices, spool valves and pistons. Official Gazette of the U.S. Patent Office

N78-24546*# California State Univ., Northridge.
STUDY OF ROLLING ELEMENT DYNAMIC INTERACTIONS WITH SEPARATORS AND RACEWAY PATHS: ROLLER TO SEPARATOR CONTACT FORCES AND CAGE TO SHAFT SPEED RATIOS IN ROLLER BEARINGS
Lester J. Nypan 31 Mar. 1978 72 p
(Grant NsG-3065)
(NASA-CR-157160) Avail: NTIS HC A04/MF A01 CSCL 13I

Cage to roller force measurements, cage to shaft forces, and cage to shaft speed ratios are reported for 115 and 118mm bore roller bearings operating at speeds of 4,000, 8,000, and 12,000 rpm under loads ranging from 360 to 6670 N (80 to 1500 lb). Author

N78-24547 South African Bureau of Standards, Pretoria.
STANDARD SPECIFICATION FOR FLOAT VALVES. PART 2: PRESSURE-ASSISTED TYPE
Nov. 1977 29 p refs In ENGLISH and AFRIKAANS Revised Supersedes SABS-752-1964 in part
(SABS-752-1977-Pt-2; ISBN-0-626-04475-8; SABS-752-1964) Copyright. Avail: Issuing Activity

The requirements for two classes and three categories (see 3.1) of pressure-assisted float valves of nominal sizes 15 mm, 20 mm, and 25 mm are presented. Author

N78-24548 South African Bureau of Standards, Pretoria.
STANDARD SPECIFICATION FOR SELF-SUPPORTING CONTAINERS OF PLASTICS MATERIALS AND OF NOMINAL CAPACITIES 5-220 l
Nov. 1977 42 p In AFRIKAANS and ENGLISH
(SABS-1176-1977; ISBN-0-626-04471-5) Copyright. Avail: Issuing Activity

Specifications are presented for self-supporting containers made of plastics materials and of nominal capacities 5-220 lambda and suitable for the storage and transportation of commodities other than explosives, compressed gases, and radio-active materials. Standards for self-supporting plastic containers, of maximum nominal capacity 10 lambda for reserve fuel for motorized vehicles are included. Author

N78-24549 South African Bureau of Standards, Pretoria.
STANDARD SPECIFICATION FOR CAST IRON GATE VALVES FOR GENERAL PURPOSES
8 Mar. 1978 48 p In ENGLISH and AFRIKAANS
(SABS-665-1978; ISBN-0-626-04552-5) Copyright. Avail: Issuing Activity

This specification covers the material and constructional requirements for cast iron gate valves (50-600 mm nominal bores) for the control of water (at a temperature not exceeding 50 C) in general purpose (mining, industrial, and irrigation) applications. Author

N78-24550 South African Bureau of Standards, Pretoria.
STANDARD SPECIFICATION FOR HIGH SPEED STEEL SPLITTING SAWS
8 Mar. 1978 33 p In ENGLISH and AFRIKAANS
(SABS-1175-1978; ISBN-0-626-04530-4) Copyright. Avail: Issuing Activity

Specifications are given for the dimensions, material, and hardness of two types of plain slitting saws ranging in diameter from 80 mm to 315 mm and having either fine or coarse teeth. Metal slitting saws having cutting edges on the sides of the blade are not covered. Author

N78-24551*# Optical Coating Lab., Inc., City of Industry, Calif. Photoelectronics Div.
ASSESSMENT OF PRESENT STATE-OF-THE-ART SAWING TECHNOLOGY OF LARGE DIAMETER INGOTS FOR SOLAR SHEET MATERIAL Quarterly Report, 1 Sep. - 30 Nov. 1977
H. I. Yoo 30 Nov. 1977 53 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100)
(NASA-CR-157095; DOE/JPL-954830-77/12; QR-1) Avail: NTIS HC A04/MF A01 CSCL 13H

The objective of this program is to assess the present state-of-the-art sawing technology of large diameter silicon ingots (3 inch and 4 inch diameter) for solar sheet materials. During

this period, work has progressed in three areas: (1) slicing of the ingots with the multiblade slurry saw and the I.D. saw, (2) characterization of the sliced wafers, and (3) analysis of direct labor, expendable material costs, and wafer productivity.
Author

N78-24552*# Battelle Columbus Labs., Ohio.
DEVELOPMENT AND EVALUATION OF DIE AND CONTAINER MATERIALS Quarterly Progress Report, 1 Oct. - 31 Dec. 1977
R. R. Wills 18 Jan. 1978 41 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954876)
(NASA-CR-157069; DOE/JPL-954876-78/1; QR-1) Avail: NTIS HC A03/MF A01 CSCL 13I

Commercial high purity ultrafine Si3N4, Al2O3, and SiO2 powders were vacuum dried and stored under nitrogen in sealed containers. Extensive analysis of the chemical, physical, and morphological characteristics of these powders was performed. The interaction of molten silicon with fused quartz was examined in a Knudsen cell using a mass spectrometer. The solubility of oxygen at the melting point of silicon was calculated to be 1.78 times 10 to the 18th power atoms/cu cm, and the activity coefficients of oxygen and silicon monoxide, the major vapor species, were calculated to be 4.83 times 10 to the minus 24th power and 0.0000701, respectively. Author

N78-24553*# RCA Labs., Princeton, N. J.
DEVELOPMENT AND EVALUATION OF DIE MATERIALS FOR USE IN THE GROWTH OF SILICON RIBBONS BY THE INVERTED RIBBON GROWTH PROCESS, TASK 2, LSSA PROJECT Quarterly Report
M. T. Duffy, S. Berkman, G. W. Cullen, and H. I. Moss Dec. 1977 31 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954901)
(NASA-CR-157096; QR-1; PRRL-77-CR-53; ERDA/JPL-954901-77/1) Avail: NTIS HC A03/MF A01 CSCL 13I

Silicon sessile drop experiments were performed on a variety of commercially available refractory carbides, nitrides, oxides, and borides to examine the potential of these materials for applications involving either direct contact with molten silicon or as substrates for CVD coatings in the fabrication of dies and crucibles for containing molten silicon. Simultaneous experiments were also conducted with CVD layers of SiC, Si3N4, and SiOxNy. Silicon nitride layers, deposited with NH3:SiH4 ratios ranging from 100:1 down to 5:1, were examined in sessile drop experiments to determine if the layers are degraded as a result of using lower reagent ratios. Preliminary experiments were undertaken on the stability of CVD Si3N4 near the melting point of silicon. Silicon ribbon segments were grown from vitreous carbon dies which had been coated with CVD Si3N4. Depending upon the purity of the die materials, ribbon resistivity values up to 40 Omega cm were obtained. Author

N78-24554*# National Aeronautics and Space Administration. Pasadena Office, Calif.
PORTABLE HEATABLE CONTAINER Patent Application
Lien C. Yang, inventor (to NASA) (JPL) Filed 19 Apr. 1978 12 p
(Contract NAS7-100)
(NASA-Case-NPO-14237-1; US-Patent-Appl-SN-897831) Avail: NTIS HC A02/MF A01 CSCL 13D

A container is described which can be designed to heat its outer surface as to sterilize it, or to heat its inner surface and any contents within. In a container that self sterilizes its outer surface, the container includes a combustible layer of thermit type pyrotechnic material which can be ignited to generate considerable heat. Thin casing around the combustible layer which is of highly thermally conductive materials such as aluminum can be heated to a high temperature by the ignited combustible layer. A buffer layer which may be of metal, lies within the combustible layer, and a layer of insulation such as Teflon lies within the buffer layer to insulate the contents of the container from the heat. The thicknesses of the thermit type charge of the combustible layer and of the casing are chosen so that the amount of heat from the charge heats the casing to a temperature which is only moderately high to avoid melting the casing.
Official Gazette of the U.S. Patent Office

N78-24555*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TISSUE STIMULATOR ENCLOSURE WELDING FIXTURE
Sidney R. McClure Oct. 1977 27 p
(NASA-TM-79529) Avail: NTIS HC A03/MF A01 CSCL 06B

It was demonstrated that the thickness of the stimulator titanium enclosure is directly related to the battery recharge time cycle. Reduction of the titanium enclosure thickness from approximately 0.37 mm (0.015 inch) to 0.05 mm (0.002 inch) significantly reduced the recharge time cycle and thereby patient inconvenience. However, fabrication of titanium enclosures from the thinner material introduced problems in forming, holding, and welding that required improvement in state of the art shop practices. The procedures that were utilized to resolve these fabrication problems are described. Author

N78-24556# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
DEVELOPMENT OF MAINSHIFT HIGH SPEED CYLINDRICAL ROLLER BEARINGS FOR GAS TURBINE ENGINES Interim Report, 1 Oct. 1975 - 1 Apr. 1977
P. F. Brown, L. J. Dobek, F. C. Hsing, and J. R. Miner Apr. 1977 121 p refs
(Contract N00140-76-C-0383)
(AD-A052351; PWA-FR-8615) Avail: NTIS HC A06/MF A01 CSCL 21/5

This combined analytical and experimental program is aimed at generating a manual that will permit the design of 3.0 MDN cylindrical roller bearings. The roller bearing analysis will be correlated with the results from a series of bearing tests designed to determine, by statistical methods, the effect of geometrical variables on bearing performance. An existing quasi-static design optimization system has been upgraded and the basic analyses for use in developing a program to predict the dynamic behavior of roller bearing components are nearly complete. A study identified a total of thirty separate bearing parameters that can influence roller skewing and skidding. Two groups of 124 mm roller bearing designs were then prepared using statistical design techniques and incorporating parameters from the list of thirty. Fabrication of full-scale bearing hardware was completed and testing was initiated on the first group of bearings.
Author (GRA)

N78-24557# United Technologies Corp., Stratford, Conn. Sikorsky Aircraft Div.
ADVANCED OVERRUNNING CLUTCH TECHNOLOGY Progress Report, 14 Mar. - 14 Jun. 1976
Jules G. Kish Dec. 1977 316 p refs
(Contract DAAJ02-74-C-0028; DA Proj. 1F2-62209-AH-76)
(AD-A052635; USAAMRDL-TR-77-16) Avail: NTIS HC A14/MF A01 CSCL 01/3

This report documents a study to find overrunning clutch concepts suitable for use in helicopters. Ten designs were selected for in-depth evaluation, and from these, three were selected for fabrication and testing: the spring, the sprag, and the ramp-roller clutches. These performed satisfactorily in the tests, and a design guide was compiled for them (USAAMRDL-TR-77-18).
Author (GRA)

N78-24558# Stanford Research Inst., Menlo Park, Calif.
POTENTIAL FOR REUSABLE, HOMOGENEOUS CONTAINERS Final Report
Richard L. Goen, R. V. Steele, L. P. Somogyi, Thomas R. Parks, and Norman Fishman Jul. 1977 83 p refs
(Grant NSF AER-76-02396)
(PB-277444; NSF/RA-770396) Avail: NTIS HC A05/MF A01 CSCL 13C

The widespread use of disposable packaging in the United States not only expends considerable energy and materials but also contributes to a rapidly growing solid waste problem. The introduction of reusable, homogeneous containers into the packaging market could contribute significantly to the alleviation of these problems. This study examines the feasibility of reusable containers for food products (excluding beverages). Concepts are formulated for reusable containers, including consideration of

configuration and type of material. The energy used and material for the reusable container systems are compared with those of the present container systems. The cost of returning empty containers are estimated. Potential technical problems are identified. The concept of reusable food containers appears promising, but technical problems remain to be resolved, and implementation strategies must be developed. GRA

N78-24559# Argonne National Lab., Ill.
EBV BALL-VALVE STEM FAILURE: SYNTHANE COAL-GASIFICATION PILOT PLANT, FAILURE ANALYSIS REPORT
Steven Danyluk and Gabriel M. Dragel Jan. 1977 32 p
(Contract W-31-109-eng-38)
(ANL/MSD/FE-77-4) Avail: NTIS HC A03/MF A01

A 51-mm (2-in.) ball valve at the exit port of the pressurized coal feed hopper from the Synthane pilot plant failed by complete fracture of the valve stem. The failure was mechanical in nature. Surface nicks were observed at the junction between the valve stem and valve body. These surface defects provided the initiation sites for the crack. The motor drive (actuator) used to operate the valve could not provide sufficient torque to have caused the failure without preexistent surface defects. The ball-valve surfaces that had been in contact with the pulverized coal were pitted. This appeared to be due to a chemical interaction between the coal and the steel and not mechanical erosive wear. The pitting was not involved in the failure. ERA

N78-24560# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
HIGH TEMPERATURE GAS TURBINE ENGINE COMPONENT MATERIALS TESTING PROGRAM, TASK 1 Monthly Technical Progress Report, 1-31 Jul. 1977
Martin B. Cutrone 15 Aug. 1977 34 p
(Contract EX-76-C-01-1765)
(FE-1765-35; FFP-FC-MT3; MTPR-25) Avail: NTIS HC A03/MF A01

Initial liquids testing was completed using creosote doped with H-coal sludge to nominal 500 ppM ash level. Alkali levels were 12 ppM sodium and 6 ppM potassium. Examination of hot gas path components showed significantly heavier deposits than in earlier tests at 150 ppM ash. Preparations for confirmation tests continued with fabrication of test specimen hardware and an initial checkout run of the gasifier/cleanup system. Tests were started in the small burner test stands to assess the degree of conversion of insoluble alkali forms in the liquid fuel to corrosive soluble forms. Preliminary evaluations of test data indicate that nearly all the alkali in mineral form in the fuel is converted to soluble forms by combustion. ERA

N78-24561# Scientific Translation Service, Ann Arbor, Mich.
DEVICE FOR CONNECTING TWO TUBULAR DUCTS MOUNTED END-TO-END
Alfred Bentz, Yves Depierre, and Henri Venobre Oct. 1977 12 p Transl. into ENGLISH from Patent Application no. 7331539 (France), publication no. 2 242 631, 31 Aug. 1973 12 p Sponsored by DoE
(ANL-Trans-1109) Avail: NTIS HC A02/MF A01

A device is described for connecting two tubular ducts, particularly two pipelines traversed by a liquid underpressure, and allowing for relative displacement of these ducts in any direction, either along the direction of their common axis or in a plane perpendicular to this direction, or in any direction combining one and the other of these two displacements, while assuring free flow of the liquid from one duct to the other. The invention applies particularly, when the ducts consist of pipelines installed in the interior of a sodium-cooled fast nuclear reactor. The device assures connection of the outlet diffuser duct of a primary pump forming the sodium circulation in the tank through the core and heat exchangers, and of a large-diameter pipeline conducting the sodium thus delivered by the pump under the core support slab. ERA

N78-24562 National Technical Information Service, Springfield, Va.
GAS AND STEAM TURBINES, GENERAL: CORROSION AND EROSION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jan. 1978
Guy E. Habercom, Jr. Mar. 1978 276 p Supersedes NTIS/PS-77/0084; NTIS/PS-76/0087; NTIS/PS-75/126 2 Vol.
(NTIS/PS-78/0167/3; NTIS/PS-77/0084; NTIS/PS-76/0087; NTIS/PS-75/126) Avail: NTIS HC $28.00/MF $28.00 CSCL 21E

General components of gas/steam turbines exposed to corrosive and erosive environments are analyzed in these reports gathered in a worldwide literature survey. Analysis of cavitation related erosion/corrosion has been excluded from these citations. GRA

N78-24563 National Technical Information Service, Springfield, Va.
GAS AND STEAM TURBINES, GENERAL: CORROSION AND EROSION. CITATIONS FROM THE ENGINEERING DATA BASE Progress Report, 1970 - Jan. 1978
Guy E. Habercom, Jr. Mar. 1978 227 p Supersedes NTIS/PS-77/0085; NTIS/PS-76/0088 2 Vol.
(NTIS/PS-78/0168/1; NTIS/PS-77/0085; NTIS/PS-76/0088) Avail: NTIS HC $28.00/MF $28.00 CSCL 21E
For abstract, see N78-24562.

N78-24564# Maine Dept. of Transportation, Bangor. Material and Research Div.
ENERGY USE AND OTHER COMPARISONS BETWEEN DIESEL AND GASOLINE PICKUP TRUCKS Interim Report, Oct. 1976 - Jun. 1977
Kenneth M. Jacobs Jan. 1978 25 p refs
(Contract DOT-TSC-1299)
(PB-277464; DOT-TSC-OST-77-6) Avail: NTIS HC A02/MF A01 CSCL 13F

The State of Maine Department of Transportation (MDOT) was planning to acquire 28 new pickup trucks in the fall of 1976. When the U.S. Department of Transportation's Transportation Systems Center became aware of this, preliminary discussions were initiated relative to the possibility of an energy and cost study being completed on these units. It was believed that if 14 diesel and 14 gasoline units were ordered and monitored it would provide a good base for analyzing these two factors. GRA

N78-25042# Joint Publications Research Service, Arlington, Va.
POSITIONING DRIVE FOR TRANSLATORY MOVEMENTS
W. Krause and R. Boden *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 30 (JPRS-70714) 2 Mar. 1978 p 64-67 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 20, no. 10, 1977 p 105-106 (For availability see N78-25037 15-99)
Copyright. Avail: NTIS HC A06/MF A01

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N78-24565*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
QUANTITATIVE ULTRASONIC EVALUATION OF MECHANICAL PROPERTIES OF ENGINEERING MATERIALS
Alex Vary 1978 37 p refs Presented at 1st Intern. Symp. on Ultrasonic Mater. Characterization, Gaithersburg, Md., 7-9 Jun. 1978; cosponsored by NBS and Am. Soc. Nondestructive Testing.
(NASA-TM-78905; E-9640) Avail: NTIS HC A03/MF A01 CSCL 14D

Progress in the application of ultrasonic techniques to nondestructive measurement of mechanical strength of engineering materials is reviewed. A dormant concept in nondestructive evaluation (NDE) is invoked. The availability of ultrasonic methods that can be applied to actual parts to assess their potential susceptibility to failure under design conditions is discussed. It was shown that ultrasonic methods yield measurements of elastic moduli, microstructure, hardness, fracture toughness, tensile

strength, yield strength, and shear strength for a wide range of materials (including many types of metals, ceramics, and fiber composites). It was also indicated that although most of these methods were shown feasible in laboratory studies, more work is needed before they can be used on actual parts in processing, assembly, inspection, and maintenance lines. Author

N78-24566*# California Univ., Los Angeles. Dept. of Materials.
X-RAY MEASUREMENTS OF STRESSES AND DEFECTS IN EFG AND LARGE GRAINED POLYCRYSTALLINE SILICON RIBBONS. LOW COST SILICON SOLAR ARRAY PROJECT Quarterly Report
C. N. J. Wagner Jan. 1978 13 p refs Sponsored in part by NASA and DOE Prepared for JPL
(Contract JPL-954851)
(NASA-CR-157075; QR-1) Avail: NTIS HC A02/MF A01 CSCL 14D

The first model of a modified Bond goniometer was built and tested for the precision measurement of interplanar spacings in Si-single crystals. A change in interplanar spacing can be detected which corresponds to surface stresses of the order of plus or minus 1000 psi. A second version of the goniometer is being assembled incorporating a removable microscope for precision alignment of the Si-strip into the primary X-ray beam. Author

N78-24567# Pittsburgh Univ., Pa. Dept. of Mathematics.
RELIABILITY SYSTEMS WITH EXPONENTIAL SYSTEM LIFE AND IFRA COMPONENT LIVES
Henry W. Block and Thomas H. Savits Nov. 1977 13 p refs
(Contract N00014-76-C-0839; Grant NSF MCS-77-01458)
(AD-A052775; RR-77-05) Avail: NTIS HC A02/MF A01 CSCL 14/4

Reliability systems formed with independent IFRA components whose system life is exponential are studied. It is shown that in the case of monotonic systems, the system must be essentially a series system of exponential components; in the case of systems where the life is the sum of the component lives, all but one of the components are degenerate at zero and the remaining one is exponential. Author (GRA)

N78-24568# Auburn Univ., Ala.
COMPUTER AIDED OPTICAL NONDESTRUCTIVE FLAW DETECTION SYSTEM FOR COMPOSITE MATERIALS Final Technical Report
John A. Schaeffel (Army Missile Res. and Develop. Command), Bobby R. Mullinix, William F. Ranson, and Weldon F. Swinson 26 Sep. 1977 185 p refs
(Contract DAAK40-77-C-0028)
(AD-A052674; DRDMI-T-78-5) Avail: NTIS HC A09/MF A01 CSCL 11/5

This study concerns the nondestructive detection and quantification of flaws and voids in thin, cylindrical, fiber reinforced, composite structures. Three different types of flaws were investigated using double exposure optical holography shearing speckle interferometry and Young's Fringe methods. The theory for each technique and photographs of the fringe patterns are presented. The fringe density plots were made by manual and computer methods, and the flaw sizes were determined. The displacements and strains were computed. The results show that flaws in their fiber reinforced composite structures can be detected and the size determined either by optical holographic, shearing speckle, or single beam speckle interferometric techniques. A complete nondestructive testing system to detect, locate, size, and quantify flaws in fiber reinforced composite missile launch tubes and motor cases was designed including the hardware and software. The system was assembled, interfaced, checked, and the data from it validated. Complete documentation on the system components is presented or referenced. GRA

N78-24569# Tennessee Univ., Knoxville.
COMPUTER AIDED APPROACH TO QUALITATIVE AND QUANTITATIVE COMMON CAUSE FAILURE ANALYSIS FOR COMPLEX SYSTEMS
C. L. Cate, D. P. Wagner, and J. B. Fussell 1977 22 p refs Presented at 8th Ann. Conf. on Modeling and Simulation, Pittsburgh, 21 Apr. 1977
(Contracts EY-76-C-15-1200; EY-76-C-15-0003)
(CONF-770438-3) Avail: NTIS HC A02/MF A01

Existing methods of computer aided common cause failure analysis are extended by allowing analysis of the complex systems often encountered in practice. The methods aid in identifying potential common cause failures and also address quantitative common cause failure analysis. ERA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N78-24570# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
MARGINAL AND INITIAL CONDITIONS FOR APPLICATION OF THE MATRIX METHOD
H.-G. Koebler and R. Fischer 1977 9 p refs Presented at 2. Sitzung des Arbeitskreises fuer Betriebsfestigkeit (Anwendung von Prozessrechnern bei Betriebsfestigkeitsuntersuchungen), Darmstadt, West Ger., 23-24 Feb. 1977; sponsored by Deutscher Verband fuer Materialpruefung E. V. (DVM)
(ICAF-968) Avail: NTIS HC A02/MF A01

A matrix method is used to produce standardized fatigue loading sequences. The numerical development of a transfer matrix in a stationary Gaussian process is reported that optimizes reversion points and amplitude values during loading sequence. Random number sequencing was used for matrix transfer in a reversion points series. Special methods insure identical sequencing of reversion points after ending of a period. Transl. by G.G.

N78-24571# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
PROCEEDINGS OF THE 9TH ICAF SYMPOSIUM: FATIGUE LIFE OF STRUCTURES UNDER OPERATIONAL LOADS
O. Buxbaum, comp. and D. Schuetz, comp. 1977 644 p refs Symp. held at Darmstadt, West Ger., 11-12 May 1977
(LBF-TR-136(1977); ICAF-960) Avail: NTIS HC A99/MF A01

The National Aeronautics and Space Administration has conducted research during the past decade to demonstrate the viability and desirability of using composites, principally for civil aircraft. Similar research under sponsorship of the Department of Defense has been in progress to exploit these materials for military aircraft systems. Some of the NASA programs are outlined and examples are given of structural improvements which have been demonstrated. An evaluation is also given on complementary research to create the technology needed to design composite structures with confidence. Author

N78-24572*# Lehigh Univ., Bethlehem, Pa.
BONDED ORTHOTROPIC STRIPS WITH CRACKS
F. Delale and F. Erdogan Jun. 1978 53 p refs
(Grants NGR-39-007-011; NSF ENG-77-19127)
(NASA-CR-157143) Avail: NTIS HC A04/MF A01 CSCL 20K

The elastostatic problem for a nonhomogeneous plane which consists of two sets of periodically arranged dissimilar orthotropic strips is considered. First, the problem of cracks fully imbedded into the homogeneous strips is considered. Then, the singular behavior of the stresses for two special crack geometries is studied in some detail. The first is the case of a broken laminate in which the crack tips touch the interfaces. The second is the case of cracks crossing the interfaces. A number of numerical examples are worked out in order to separate the primary material parameters influencing the stress intensity factors and the powers of stress singularity, and to determine the trends regarding the influence of the secondary parameters. Finally, some numerical results are given for the stress intensity factors in certain basic crack geometries and for typical material combinations. Author

N78-24573*# Lehigh Univ., Bethlehem, Pa.
THE PROBLEM OF AN INCLINED CRACK IN AN ORTHOTROPIC STRIP

F. Delale (Tech. Univ. of Istanbul, Turkey), I. Bakirtas (Tech. Univ. of Istanbul, Turkey), and F. Erdogan Apr. 1978 30 p refs
(Grant NGR-39-007-011; NSF ENG-77-19127)
(NASA-CR-157142) Avail: NTIS HC A03/MF A01 CSCL 20K

The elastostatic problem for an infinite orthotropic strip containing crack was considered. It was assumed that the orthogonal axes of material orthotropy may have an arbitrary angular orientation with respect to the orthogonal axes of geometric symmetry of the uncracked strip. The crack was located along an axis of orthotropy, hence, at an arbitrary angle with respect to the sides of the strip. The general problem was formulated in terms of a system of singular integral equations for arbitrary crack surface tractions. As examples Modes 1 and 2 stress intensity factors were calculated for the strip having an internal or an edge crack with various lengths and angular orientations. Author

N78-24574*# Lehigh Univ., Bethlehem, Pa.
STRESS INTENSITY FACTORS IN BONDED HALF PLANES CONTAINING INCLINED CRACKS AND SUBJECTED TO ANTIPLANE SHEAR LOADING
J. L. Bassani and F. Erdogan Apr. 1978 32 p refs
(Grants NGR-39-007-011; NSF ENG-77-19127)
(NASA-CR-157137) Avail: NTIS HC A03/MF A01 CSCL 20K

The antiplane shear problem for two bonded dissimilar half planes containing a semi-infinite crack or two arbitrarily located collinear cracks was considered. For the semi-infinite crack the problem was solved for a concentrated wedge load and the stress intensity factor and the angular distribution of stresses were calculated. For finite cracks the problem was reduced to a pair of integral equations. Numerical results were obtained for cracks fully imbedded in a homogeneous medium, one crack tip touching the interface, and a crack crossing the interface for various crack angles. Author

N78-24575*# Lehigh Univ., Bethlehem, Pa.
STRESS INTENSITY FACTORS IN A CRACKED INFINITE ELASTIC WEDGE LOADED BY A RIGID PUNCH
F. Erdogan and M. B. Civelek May 1978 44 p refs
(Grants NGR-39-007-011; NSF ENG-77-19127)
(NASA-CR-157136) Avail: NTIS HC A03/MF A01 CSCL 20K

A plane elastic wedge-shaped solid was split through the application of a rigid punch. It was assumed that the coefficient of friction on the the contact area was constant, and the problem had a plane of symmetry with respect to loading and geometry, with the crack in the plane of symmetry. The problem was formulated in terms of a system of integral equations with the contact stress and the derivative of the crack surface displacement as the unknown functions. The solution was obtained for an internal crack and for an edge crack. The results include primarily the stress intensity factors at the crack tips, and the measure of the stress singularity at the wedge apex, and at the end points of the contact area. Author

N78-24576# Indian Inst. of Tech., Madras. Dept. of Applied Mechanics.
NONLINEAR STRUCTURAL RESPONSE TO SONIC BOOMS
R. S. Alwar and Yogendra Nath 31 Jan. 1977 31 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Sep. 1978
Avail: NTIS HC A03/MF A01

The influence of the large amplitude and damping on the response of an isotropic circular plate with special reference to glass like materials subjected to sonic booms has been studied for several boom parameters like overpressure, wave form, duration and rise time. The governing nonlinear differential equations of motion are linearised by using Taylor series expansion and the analysis is performed with Chebyshev polynomials. It is shown that for a practical case the amplitude of vibration may be the order of the thickness. Author

N78-24577*# University of Southern Calif., Los Angeles. Dept. of Civil Engineering.
FINITE ELEMENT ANALYSIS OF LAMINATED PLATES AND SHELLS, VOLUME 1 Annual Progress Report, Mar. 1977 - Mar. 1978
Paul Seide and Peter N.-H. Chang Mar. 1978 132 p refs
(Grant NsG-1401)
(NASA-CR-157106) Avail: NTIS HC A07/MF A01 CSCL 20K

The finite element method is used to investigate the static behavior of laminated composite flat plates and cylindrical shells. The analysis incorporates the effects of transverse shear deformation in each layer through the assumption that the normals to the undeformed layer midsurface remain straight but need not be normal to the mid-surface after deformation. A digital computer program was developed to perform the required computations. The program includes a very efficient equation solution code which permits the analysis of large size problems. The method is applied to the problem of stretching and bending of a perforated curved plate. Author

N78-24578*# University of Southern Calif., Los Angeles. Dept. of Civil Engineering.
FINITE ELEMENT ANALYSIS OF LAMINATED PLATES AND SHELLS, VOLUME 2 Annual Progress Report, Mar. 1977 - Mar. 1978
Paul Seide and Peter N. H. Chang Mar. 1978 164 p
(Grant NsG-1401)
(NASA-CR-157107) Avail: NTIS HC A08/MF A01 CSCL 20K

For abstract, see N78-24577.

N78-24579# Army Armament Research and Development Command, Watervliet, N. Y. Weapons Lab.
EFFECT OF DAMPING AT THE SUPPORT OF A ROTATING BEAM ON VIBRATIONS
J. D. Vasilakis and J. J. Wu Oct. 1977 27 p refs
(AD-A051293; AD-E400082; ARLCB-TR-77042) Avail: NTIS HC A03/MF A01 CSCL 20/11

The paper presents a formulation for the study of damping effects in dynamic structural problems and a specific application. A finite element formulation is first derived from the versatile unconstrained variational approach. The vibration of a rotating beam is used here as a concrete example. Viscous damping terms at the support can be present due to either local deflection or rotation. These terms can obviously affect the frequencies of the rotating beam. They are easily incorporated in the present formulation using the concept of unconstrained variations. Numerical data will be presented to demonstrate the qualitative as well as quantitative effects on the vibratory behavior of this rotating beam due to such damping terms. Author (GRA)

N78-24580# Naval Research Lab., Washington, D. C.
FRACTURE INITIATION IN IRDOME GRADE MgF2 Interim Report
R. W. Rice, S. M. Morey, and F. W. Fraser Jan. 1978 30 p
(RR0220241; WF54595201)
(AD-A051301; AD-E000112; NRL-MR-3685) Avail: NTIS HC A03/MF A01 CSCL 11/2

Analysis of Irdome grade MgF2 specimens from one of the leading MgF2 manufacturers showed that 50-75% often failed from foreign particles or occasionally large grains. The foreign particles were almost exclusively SiO2, which appears to be introduced by abrasion from the SiO2 crucibles used for processing the SiO2 powder. Elimination of these particles would be relatively easy, but is not expected to significantly raise strengths because machining flaws, which are the other predominant source of failure limits strengths to similar levels as the SiO2 particles do. Practical limitation on reducing the sizes of machining flaws indicate that if significantly improved mechanical performance of Irdomes is required, it is not likely to be obtained by improving MgF2. Development of new materials is thus required to provide higher performance. Author (GRA)

N78-24581# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GENERALIZATION OF THE STATISTICAL THEORY OF STRENGTH FOR THE CASE OF THE NONUNIFORMLY STRESSED STATE

T. A. Kontorova and O. A. Timoshenko 13 Oct. 1977 36 p refs Transl. into ENGLISH from Zh. Tekhn. Fiz. (USSR), v. 19, no. 3, 1949 p 355-370
(AD-A051389; FTD-ID(RS)T-1748-77) Avail: NTIS HC A03/MF A01 CSCL 10/11

The theory presented above does not in any way pretend toward universality. It is only one of many possible variants of a statistical description of the role of different types of defects present in real materials. This variant seems however, to be one of the most sensible, since the distribution function choice is made of the Gaussian function, which has recommended itself so well in considering a number of allied questions.
Author (GRA)

N78-24582# Illinois Inst. of Tech., Chicago.
UNIFIED ELASTIC PLASTIC CONSTITUTIVE EQUATION AND APPLICATION TO HYDRAULIC AUTOFRETTAGE PROBLEMS Final Report, 15 Jan. - 14 Dec. 1977
Barry Bernstein 15 Mar. 1978 21 p refs
(Grant DAAG29-77-G-0082)
(AD-A052823; ARO-14716.3-R-E) Avail: NTIS HC A02/MF A01 CSCL 20/11

Work is reported on the development of a set of unified rate type constitutive equations for elastic and plastic behavior, and of the formulation of generalized plane strain problems of hydraulic autofrettage in terms of these equations, as well as some initial computations in terms of the formulation. The unified equations apply to both loading and unloading. Elasticity is related to uniqueness of solutions of differential equations and occurs when a Lipshitz condition is in force. Plastic yield response occurs during loading when the Lipshitz condition fails. Failure of the Lipshitz condition corresponds to the von Mises yield condition. During yield, the equations automatically become those of Prandtl-Reuss. During unloading, the stable solution dictates a reentry to an elastic regime. Linear elastic-perfectly plastic behavior can be approximated arbitrarily closely. Extension to strain hardening can be included. The problem of generalized plane strain in hydraulic autofrettage is reduced to a system of ordinary differential equations with initial conditions. A computer program is written for the open end condition in the incompressible case with an instruction which insures a slight perturbation during yield. GRA

N78-24583# Carnegie Inst. of Tech., Pittsburgh, Pa. Dept. of Civil Engineering.
SYMBOLIC GENERATION OF FINITE ELEMENT STIFFNESS MATRICES
Alan R. Kornoff and Steven J. Fenves Jan. 1978 119 p refs (Contract N00014-76-C-0345; NR Proj. 064-536)
(AD-A052561; R-78-103) Avail: NTIS HC A06/MF A01 CSCL 12/1

A symbolic processor, *****(pronounced five star), to assist in the generation of stiffness matrices for finite elements, based on a recently developed symbolic processor, is presented. Operations are performed upon element characteristics and material properties in symbolic form to produce a matrix template, consisting of the algebraic expressions generated for the stiffness coefficients as functions of the problem parameters in literal form. The template may be evaluated for a given element by binding these symbolic forms to the numerical values associated with a specific element. The evaluation process is further facilitated by permitting specification of a variety of output formats for the resulting matrix template. Required input is minimized by automatically synthesizing the constituent matrices of the formulation from user-supplied specifications of shape functions, material properties and stress-strain relationships, all in symbolic notation. The processor, written in MACSYMA, is highly interactive providing prompts for user input, enumeration of available program options, and extensive on-line assistance. GRA

N78-24584# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
ISOPARAMETRIC ELEMENTS AS SINGULAR ELEMENTS FOR CRACK PROBLEMS
M. A. Hussain and W. E. Lorensen Nov. 1977 62 p refs
(AD-A052583; AD-E400119; ARLCB-TR-77041) Avail: NTIS HC A04/MF A01 CSCL 20/11

The quadratic isoparametric elements, which embody the inverse square root singularity, are used for calculating the stress intensity factors at tips of cracks. The elements used are the quadratic quadrilateral (8-node), quadratic triangular (6-node) and three-dimensional quadratic brick (20-node) elements. Singularity elements are obtained in a simple manner by placing the mid-side nodes at quarter points in the vicinity of the crack tip or on edge. These elements are implemented in NASTRAN as dummy (user) elements. The method eliminates the use of special crack tip elements and in addition, these elements satisfy the constant strain and rigid body modes required for convergence. The stability of two-dimensional elements is also investigated. Author (GRA)

N78-24585# Liege Univ. (Belgium).
STRUCTURAL OPTIMIZATION BY FINITE ELEMENT Final Report, Oct. 1976 - Dec. 1977
C. Fleury and G. Sander Jan. 1978 232 p refs
(Grant AF-AFOSR-3118-77)
(AD-A052412; LTAS-NBR-SA-58; AFOSR-78-0670TR) Avail: NTIS HC A11/MF A01 CSCL 20/11

The relations existing between optimality criteria and mathematical programming methods of structural synthesis are examined. Generalized optimality criteria are proposed which are equivalent to a sequence of approximate problems in which the constraints are linearized in the space of the inverse of the design variables. From this equivalence a certain number of mixed approaches are derived which retain some of the essential properties of mathematical programming methods and of optimality criteria. Author (GRA)

N78-24586# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Design Office Strength and Design.
FINITE ELEMENT BEAM COLUMN ANALYSIS
J. H. VanderSloot Feb. 1977 27 p ref
(FOK-SM-91) Avail: NTIS HC A03/MF A01

A beam column under compressive loads with initial curvature exhibits typically different behavior as compared to linear elastic response of structural members within the framework of small displacement theory. For rings and beams with small initial curvature, with bending stiffness appreciably smaller than the extensional stiffness, the load-deflection dependency must be accounted for. Each load level requires the solution of equilibrium equations as contrasted to results obtained in the linear theory where a load factor covers the complete loading range. The finite element approach for such beams is presented. The derivation of equilibrium equations and boundary conditions is given where the principle of the minimum of the total potential energy is utilized. The non-linearity of the problem is accounted for through the strain-displacement equations for extensional deformations. The linear moment-curvature relation is considered where an upper bound for the load is derived in relation to this assumption. It is further indicated that the problem can be linearized, in such a way that a quasi-linear equation results. This aspect is reflected in the load dependent stiffness matrix. The finite element development is given. Author (ESA)

N78-24587# Societe Nationale Industrielle Aerospatiale, Suresnes (France). Lab. Central.
CAN FATIGUE CRACKS BE DETECTED IN AN EARLY STAGE BY ACOUSTIC EMISSION? APPLICATION TO HIGH RESISTANCE LIGHT ALLOYS USED IN AERONAUTICS
C. Bathias, B. Brintet, and G. Sertour Paris Assoc. Aeron. et Astronautique de France 1977 11 p refs In FRENCH; ENGLISH summary Presented at the 8th World Conf. on Nondestructive Testing, Cannes, France, 6-11 Sep. 1976
(AAAF-NT-77-35; ISBN-2-7170-0460-2) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

A study carried out on different types of test pieces (shot blasted, anodized, notched) has shown that acoustic emission provides an accurate method for following fatigue damage up to crack initiation. ESA

N78-24588# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
FINITE ELEMENT ANALYSIS OF INELASTIC STRUCTURAL BEHAVIOR
J. H. Argyris, K. S. Pister (Calif. Univ., Berkeley), J. Szimmat, L.

E. Vaz, and K. J. William Jul. 1977 57 p refs Presented at the 4th Intern. Conf. on Struct. Mech. in Reactor Technol., San Francisco, 15-19 Aug. 1977 Submitted for publication
(ISD-225) Avail: NTIS HC A04/MF A01

Computational aspects of dissipation and diffusion problems which describe inelastic mechanical processes and transport mechanisms in transient environments were examined. Both phenomena are rate processes which lead in general to a system of coupled first order differential equations after finite element idealization of the spatial dependence. The discussion of inelastic analysis is illustrated with the hygrothermal creep analysis of a prestressed concrete reactor vessel exposed to a realistic loading history involving prestress and cyclic pressurization, drying, and heating. Author (ESA)

N78-24589# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
INTERACTIVE GRAPHICAL PRE- AND POSTPROCESSING FOR FINITE ELEMENT ANALYSIS WITH INGA
Ingolf Grieger Oct. 1977 25 p refs Presented at the 6th Univac User Assoc./Europe Struct. Anal. Special Interest Group Meeting, Madrid, 13-14 Oct. 1977
(ISD-228) Avail: NTIS HC A02/MF A01

The interactive system INGA (Interactive Graphic Analysis) for computer aided structural analysis and design is presented. Topics include hardware requirements, design philosophy, system operations, and interactive mesh generation. Some examples (a construction of prestressed concrete, a plane structure, in which the use of geometry elements in mesh generation problems are shown, and a disk with holes) are presented. ESA

N78-24590# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NON-LINEAR DEFORMATIONS AND STATIC BUCKLING
Roger Valid 1977 76 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-478)
(ONERA-P-1977-2) Avail: NTIS HC A05/MF A01

Recapitulating some variational formulations and discretized methods, new results are provided, in particular in the field of the large displacements shell theory. The classical perturbation method was applied in the study and discussion of buckling and post-buckling, but by means of systematic methods, some aspects of which are original. The case of multi-bifurcation points was examined and a discussion of their stability is touched upon. Author (ESA)

N78-24591# European Space Agency, Paris (France).
HIGH TEMPERATURE, LOW CYCLE FATIGUE TESTING MACHINE
Jean-Louis Chaboche, Humbert Policella, and Henri Kaczmarek Apr. 1978 40 p refs Transl. into ENGLISH of 'Machine d'Essais en Fatigue Oligocyclique a Haute Temp.', ONERA, Paris Report ONERA-NT-1977-10, Oct. 1977 Original report in FRENCH previously announced as N78-22410
(ESA-TT-474; ONERA-NT-1977-10) Avail: NTIS HC A03/MF A01

The ONERA Structures Department has been equiped for four years with a test rig for low cycle fatigue at high temperature. By an account being taken of the specific objectives of the research work carried out on characterization of materials behavior with a view to structures computation, the method used in this rig makes use of cylindrical tension-compression specimens, and of a system of longitudinal extensometry. The installation and its characteristics and possibilities are described and the various techniques that can be used at high temperature for this type of specimen, are reviewed. Discussions on behavior and damage models in the low cycle fatigue domain and on the definition of the equivalent useful length are annexed. Author (ESA)

N78-24209*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NASTRAN ANALYSIS OF A WHEEL-RAIL LOADING ON ITS FOUNDATION
M. S. Katow *In its* The Deep Space Network 15 Feb. 1978 p 204-215 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 20K

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N78-24592*# Geological Survey, Reston, Va. Geography Program.
GEOGRAPHIC INFORMATION SYSTEM DEVELOPMENT IN THE CARETS PROJECT (CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE), VOLUME 4 Final Report
William B. Mitchell, Principal Investigator, Robin G. Fegeas, Katherine A. Fitzpatrick, and Cheryl A. Hallam 1977 78 p refs ERTS
(NASA Order S-70243-AG)
(E78-10128; NASA-CR-157001) Avail: NTIS HC A05/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N78-24593*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
THE APPLICATION OF REMOTE SENSING TECHNOLOGY TO THE SOLUTION OF PROBLEMS IN THE MANAGEMENT OF RESOURCES IN INDIANA Semiannual Status Report, 1 Jun. - 30 Nov. 1977
R. A. Weismiller and R. P. Mroczynski, Principal Investigators 30 Nov. 1977 78 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGR-15-005-186)
(E78-10129; NASA-CR-157003; LARS-CR-042178) Avail: NTIS HC A05/MF A01 CSCL 05A

There are no author-identified significant results in this report.

N78-24594# Indian Space Research Organization, Ahmedabad. Image Processing and Analysis Div.
A PROGRAMMING SYSTEM FOR DIGITAL IMAGE PROCESSING OF REMOTELY SENSED DATA
Bangalore, India Apr. 1977 65 p refs
(ISRO-SAC-TR-04-77) Avail: NTIS HC A04/MF A01

The programming system designed for processing of multi-spectral data and multiband photographs is described and defined in terms of preprocessing and picture handling, pattern recognition and statistical analysis routines, data management, input/output routines, and computer programming. M.V.

N78-24595# Comptroller General of the United States, Washington, D.C.
LANDSAT'S ROLE IN AN EARTH RESOURCES INFORMATION SYSTEM: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OFFICE OF SCIENCE AND TECHNOLOGY POLICY
10 Jun. 1977 46 p refs
(PSAD-77-58) Avail: NTIS MF A01; GAO HC $1.00

This report updates information on LANDSAT's uses and expected benefits; cost, schedule, and performance status; future uncertainties; and international implications. This review was made at the request of the Chairman, Subcommittee on HUD-Independent Agencies, Committee on Appropriations, United States Senate. Our review work was performed primarily at the Goddard Space Flight Center, Greenbelt, Maryland, and at NASA headquarters. Information presented herein was obtained by (1) reviewing project plans, reports, correspondence, and other documents and (2) discussing aspects of the project with officials

of the Departments of State, Agriculture, the Interior, and the Office of Management and Budget. Author

N78-24596*# National Aeronautics and Space Administration, Washington, D. C.

PILOT STUDY OF VEGETATION IN THE ALCHICHICA-PEROTE REGION BY REMOTE SENSING

M. Soto, F. Lozano, A. Diez, C. Mejia, and J. Villa Jun. 1978 20 p Transl. into ENGLISH from Biotica (Mex.), v. 2, no. 3, 1977 p 19-36 Transl. by Sci. Transl. Serv., Santa Barbara, Calif. Original doc. prep. by Inst. de Invest. Sobre Recursos Bioticos, Flora de Veracruz (Mex.).

(Contract NASw-2791)

(NASA-TM-75101; Contrib-24) Avail: NTIS HC A02/MF A01 CSCL 08F

A study of the application of satellite images to the identification of vegetation in a small area corresponding to the arid zone of Veracruz and part of Puebla is presented. This study is accomplished by means of images from the LANDSAT satellite obtained on January 19 and May 23, 1973. The interpretation of the different maps is made on the basis of information from the data bank of the Flora de Veracruz program, and various surveys made by land and air. Author

N78-24597# Council on Environmental Quality, Washington, D.C.

OIL AND GAS IN COASTAL LANDS AND WATERS

Katherine Gillman Apr. 1977 159 p refs

Avail: NTIS HC A08/MF A01

The most promising domestic sources for yet undiscovered oil are, first, onshore Alaska and, next, the continental shelves in the Gulf of Alaska, the Gulf of Mexico, the Atlantic, and Pacific. The conflicts between energy needs and other vital interests of people and the coastal environments in which they live are clear. The impacts of oil on the coastal zone are described, so far as they are known, and possible effects of new development are discussed. Ways in which energy sources can be exploited with the least harm to the environment and most benefit to man are discussed. Author

N78-24598*# National Aeronautics and Space Administration, Washington, D. C.

THE EFFECTIVE AEROSOL ATTENUATION ON DETERMINATION ERROR OF OCEAN AND ATMOSPHERE TEMPERATURES BY REMOTE METHODS

May 1978 36 p refs Transl. into ENGLISH of "O Vliyanii Aerosolnogo Oslableniya na Oshibki Opredeleniya Temperatury Okeana i Atmosfery Distantsionnymi Metodami' Moscow, Acad. of Sci. USSR and Joint Sov.-Am. Working Group on Space Meteorol., Apr. 1978 29 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Acad. of Sci. USSR

(Contract NASw-2790)

(NASA-TM-75100) Avail: NTIS HC A03/MF A01 CSCL 05B

This article contains a survey of literature on errors in establishing temperature of the underlying surface and the vertical profile of temperature in the 15 microns CO2 band when aerosol attenuation was not taken into account. Experimental data show the large contribution of the aerosol to total radiation attentuation. Evaluations are made of the relationship of the magnitude of establishment error to location and optical thickness of the aerosol layer. Author

N78-24599*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ON THE UNIFICATION OF GEODETIC LEVELING DATUMS USING SATELLITE ALTIMETRY

R. S. Mather, C. Rizos (Johns Hopkins Univ., Balt., Md.), and T. Morrison (Univ. of New South Wales, Sydney, Australia) Apr. 1978 40 p refs Presented at 2d Intern. Symp. on Problems Related to the Redefinition of North Amer. Geodetic Networks, Arlington, Va., 24-28 Apr. 1978

(NASA-TM-79533) Avail: NTIS HC A03/MF A01 CSCL 08G

Techniques are described for determining the height of Mean Sea Level (MSL) at coastal sites from satellite altimetry. Such information is of value in the adjustment of continental leveling networks. Numerical results are obtained from the 1977 GEOS-3 altimetry data bank at Goddard Space Flight Center using the Bermuda calibration of the altimeter. Estimates are made of the heights of MSL at the leveling datums for Australia and a hypothetical Galveston datum for central North America. The results obtained are in reasonable agreement with oceanographic estimates obtained by extrapolation. It is concluded that all gravity data in the Australian bank AUSGAD 76 and in the Rapp data file for central North America refer to the GEOS-3 altimeter geoid for 1976.0 with uncertainties which do not exceed + or - 0.1 mGal. Author

N78-24600*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE EARTH'S GRAVITY FIELD AND OCEAN DYNAMICS

R. S. Mather May 1978 39 p refs Presented at 7th Symp. on Mathematical Geodesy (4th Hotine Symp.), Assisi, Italy, 8-10 Jun. 1978 Submitted for publication

(NASA-TM-79540) Avail: NTIS HC A03/MF A01 CSCL 08G

An analysis of the signal-to-noise ratio of the best gravity field available shows that a basis exists for the recovery of the dominant parameters of the quasi-stationary sea surface topography. Results obtained from the analysis of GEOS-3 show that it is feasible to recover the quasi-stationary dynamic sea surface topography as a function of wavelength. The gravity field models required for synoptic ocean circulation modeling are less exacting in that constituents affecting radial components of orbital position need not be known through shorter wavelengths. Author

N78-24601# Committee on Energy and Natural Resources (U. S. Senate).

ALASKA NATURAL RESOURCE ISSUES

Washington GPO 1977 212 p refs Hearings on S. 499, S. 1500 and S. 1546 before Comm. on Energy and Natural Resources, 95th Congr., 1st Sess., 17 and 20 Jun. 1977

(GPO-95-110) Avail: Comm. on Energy and Natural Resources

Hearings were held to provide the Committee on Energy and Natural Resources with an overview of the Department of the Interior's perceptions of Alaska natural resource issues. Specific issues addressed were: (1) the Alaska national interest lands legislation; (2) the Alaska Native Claims Settlement Act; (3) route selection for the Alaska natural gas pipeline; (4) procedures for the startup and operation of the trans-Alaska pipeline system; (5) plans for oil and gas development on the outer continental shelf off Alaska; (6) exploration, planning, and administration of the national petroleum reserve; and (7) the Department of the Interior's efforts to relate each of these issues to a general strategy for the conservation, development, and transportation of Alaska's natural resources. P.R.A.

N78-24602# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

USING SYNTHETIC IMAGES TO REGISTER REAL IMAGES WITH SURFACE MODELS

Berthold K. P. Horn and Brett L. Bachman Aug. 1977 53 p refs

(Contract N00014-75-C-0643)

(AD-A052512; AI-M-437) Avail: NTIS HC A04/MF A01 CSCL 09/4

A number of image analysis tasks can benefit from registration of the image with a model of the surface being imaged. Automatic navigation using visible light or radar images requires exact alignment of such images with digital terrain models. In addition, automatic classification of terrain, using satellite imagery, requires such alignment to deal correctly with the effects of varying sun angle and surface slope. Even inspection techniques for certain industrial parts may be improved by this means. The required alignment is achieved by matching the real image with the synthetic image obtained from a surface model and known positions of the light sources. The synthetic image intensity is calculated using the reflectance map, a convenient way of describing surface reflection as a function of surface gradient. The technique is illustrated using LANDSAT images and digital terrain models. GRA

N78-24603# Kansas Univ., Lawrence. Lawrence Remote Sensing Lab.

BACKSCATTER PROPERTIES OF SEA ICE WITH RADAR: ARCTIC OPERATIONS DESCRIPTION AND PRELIMINARY DATA SUMMARY

R. G. Onstott, G. J. Dome, R. A. Hand, James Hague, J. Pape, and R. K. Moore Oct. 1977 161 p
(Contract N00014-76-C-1105)
(AD-A052711; RSL-TM-331-1) Avail: NTIS HC A08/MF A01 CSCL 17/9

Active microwave responses of sea ice and lake ice were investigated at sites located off the North Alaskan Coast in the Arctic Ocean. The experimenters were ground-based at the Naval Arctic Research Laboratory, NARL, located outside of Barrow, Alaska, during May 1977, an early spring month in the Arctic. Microwave equipment was mounted and assembled on a portable A-frame type support system which was transported to test sites via sled and snowmobile. Data were acquired at numerous microwave frequencies, receive-transmit polarizations, and angles of incidence for 5 sea ice and 2 lake ice types. This memo documents the experiment and the experimental procedure; and lists the raw experimental data. Author (GRA)

N78-24604# Applied Science Technology, Inc., Arlington, Va.
MULTI-SENSOR SYSTEM (MUSS) FOR AIRBORNE SURVEILLANCE OF INSHORE WATERS
G. Daniel Hickman Nov. 1977 44 p refs
(Contract N00014-76-C-1042)
(AD-A052544; AST-7701) Avail: NTIS HC A03/MF A01 CSCL 15/7

Data were assembled and listed in this report on state-of-the-art aircraft sensors which could be integrated to form a Multi-Sensor System (MUSS) for surveillance of inshore waters. The following sensor categories are included: radars (active, imaging), optical multispectral spectrometers (passive, imaging), infrared scanners (passive, imaging), infrared radiometers/spectrometers (passive, non-imaging), cameras and active laser systems. The MUSS might be required to perform the following missions: (1) collect data on previously uncharted areas; (2) collect data on previously charted areas using different sensors, and (3) collect data for update and/or verification of archival data. The principal beach parameters which must be measured by the MUSS include: length, width, gradient, surf and tidal range and nearshore currents. It is possible that the MUSS would also be able to yield information on the type of sediment and trafficability of the nearshore zone in addition to locating obstacles in the surf zone and mapping the ground cover.
Author (GRA)

N78-24605# Aerojet Electrosystems Co., Azusa, Calif.
TRANSFER, INSTALLATION AND FLIGHT TESTING OF THE MODIFIED AIRBORNE OIL SURVEILLANCE SYSTEM (AOSS II) IN A HC-130 B AIRCRAFT Final Report
D. C. Meck, J. J. Bommarito, R. S. Schwantje, and A. T. Edgerton Aug. 1977 147 p
(Contract DOT-CG-52660-A)
(AD-A052434; AESC-5546; USCG-D-60-77) Avail: NTIS HC A07/MF A01 CSCL 15/4

The prototype airborne oil surveillance system (AOSS I) developed for the U.S. Coast Guard by Aerojet ElectroSystems under Contract DOT-CG-22170A was modified and transferred from a HU-16 aircraft to a HC-130B aircraft. The added capabilities of the new system configuration were verified by a flight test program. Modifications to the system included (1) the addition of a high resolution aerial reconnaissance camera, (2) the addition of a dual look (left and right) capability for the SLAR, (3) automatic SLAR target position location, (4) an airborne remote temperature measurement capability, (5) simultaneous multispectral recording capability for the IR-UV line scanner data, and (6) improved processing of passive microwave imager data. The proven system capabilities of AOSS I combined with the added capabilities incorporated into AOSS II provide a unique and valuable system to support all U.S. Coast Guard missions. The system is currently operational and based at Elizabeth City, North Carolina. GRA

N78-24606# Geological Survey, Menlo Park, Calif.
GROUND WATER IN THE KOEHN LAKE AREA, KERN COUNTY, CALIFORNIA Final Report
J. H. Koehler Dec. 1977 31 p Prepared in cooperation with the Antelope Valley-East Kern Water Agency, Calif.
(PB-277252; USGS/WRD/WRI-78/010) Avail: NTIS HC A03/MF A01 CSCL 08H

Hydrologic characteristics were investigated to determine effects of external stresses on the system. Unconsolidated deposits are greater than 900 feet thick in the central part of the basin where the Cantil Valley fault acts as a barrier to groundwater flow. Average annual consumptive use, between 1960 and 1976, is about 21,800 acre-feet per year more than recharge. Water levels have declined and a pumping depression has developed about 5 miles southwest of Koehn Lake. Groundwater in storage in 1976 was about 4 million acre-feet, and groundwater in storage above the 500-foot depth excluding the saline water under Koehn Lake was about 2 million acre-feet. Comparison of chemical analyses made during this study with historic water-quality analyses indicated no significant change. A percent reversal in groundwater gradient southwest of Koehn Lake may allow the saline water below Koehn Lake to invade the fresh-water aquifer. Author

N78-24607# Arizona Univ., Tucson.
URBAN FLOOD WATER MANAGEMENT SYSTEMS IN SEMIARID REGIONS: MODEL EXTENSION, DESIGN AND APPLICATION
K. Arai, S. Ince, and S. Snick 1977 71 p refs
(OWRT Proj. A-049-ARIZ(1))
(PB-277485; W78-03965) Avail: NTIS HC A04/MF A01 CSCL 08H

A non-linear reservoir model is used to represent the rainfall-runoff relationships for thunderstorms on the urban watersheds of Tucson, Arizona. Two types of computer programs are developed: a calibration program to obtain a best-fit calculated hydrography; and a verification program to generate storm hydrographs given the watershed characteristics and a hydrograph. Calibration reveals the relationship of the model parameters, namely, (f) the inflow coefficient, (a) the constant coefficient, and (TL) the time lag, to the total rainfall, drainage area, channel length, and infiltration capacity of the watershed. The average discrepancy between the predicted hydrograph and the actual hydrograph for Tucson urban watersheds is 20-25 percent.
Author (GRA)

N78-24193*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ESTIMATE OF PROCESSION AND POLAR MOTION ERRORS FROM PLANETARY ENCOUNTER STATION LOCATION SOLUTIONS
G. E. Pease *In its* The Deep Space Network 15 Feb. 1978 p 29-49 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 08B

N78-24235*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON THE SUITABILITY OF VIKING DIFFERENCED RANGE TO THE DETERMINATION OF RELATIVE Z-DISTANCE
F. B. Winn *In its* The Deep Space Network 15 Apr. 1978 p 203-210 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 08B

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N78-24608* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENERGY STORAGE APPARATUS Patent
Philip A. Studer and Harold E. Evans, inventors (to NASA) Issued 7 Mar. 1978 9 p Filed 30 Jul. 1976 Supersedes N76-30652 (14 - 21, p 2749)
(NASA-Case-GSC-12030-1; US-Patent-4,077,678; US-Patent-Appl-SN-710035; US-Patent-Class-308-10; US-Patent-Class-310-153; US-Patent-Class-310-269;

US-Patent-Class-310-154; US-Patent-Class-310-178) Avail: US Patent Office CSCL 10B

A high efficiency, flywheel type energy storage device which comprises an electronically commutated d.c. motor/generator unit having a massive flywheel rotor magnetically suspended around a ring shaped stator is presented. During periods of low energy demand, the storage devices were operated as a motor, and the flywheel motor was brought up to operating speed. Energy was drawn from the device functioning as a generator as the flywheel rotor rotated during high energy demand periods.

Official Gazette of the U.S. Patent Office

N78-24609* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PROCESS FOR UTILIZING LOW-COST GRAPHITE SUBSTRATES FOR POLYCRYSTALLINE SOLAR CELLS

Patent

Ting L. Chu, inventor (to NASA) (Southern Methodist Univ.) Issued 7 Mar. 1978 16 p Filed 4 Jun. 1976 Supersedes N76-26695 (14 - 17, p 2218) Continuation-in-part of US Patent Appl. SN-576488 filed 12 May 1975, US Patent-3,961,997 Sponsored by NASA

(NASA-Case-GSC-12022-2; US-Patent-4,0778,818; US-Patent-Appl-SN-693074; US-Patent-Class-148-174; US-Patent-Class-29-572; US-Patent-Class-136-89SG; US-Patent-Class-357-30; US-Patent-Class-357-59; US-Patent-Class-427-86; US-Patent-Class-427-113; US-Patent-Class-427-248J; US-Patent-Class-427-249; US-Patent-3,961,997; US-Patent-Appl-SN-576488) Avail: US Patent Office CSCL 10A

Low cost polycrystalline silicon solar cells supported on substrates were prepared by depositing successive layers of polycrystalline silicon containing appropriate dopants over supporting substrates of a member selected from the group consisting of metallurgical grade polycrystalline silicon, graphite and steel coated with a diffusion barrier of silica, borosilicate, phosphosilicate, or mixtures thereof such that p-n junction devices were formed which effectively convert solar energy to electrical energy. To improve the conversion efficiency of the polycrystalline silicon solar cells, the crystallite size in the silicon was substantially increased by melting and solidifying a base layer of polycrystalline silicon before depositing the layers which form the p-n junction.

Official Gazette of the U.S. Patent Office

N78-24610*# Contemporary Systems, Inc., Jaffrey, N. H.

PRELIMINARY DESIGN PACKAGE FOR PROTOTYPE SOLAR HEATING SYSTEM

23 Nov. 1976 54 p Prepared for DOE

(Contract NAS8-32243)

(NASA-CR-150615) Avail: NTIS HC A04/MF A01 CSCL 10A

A preliminary design review on the development of a prototype solar heating system for single family dwellings is presented. The collector, storage, transport, control, and site data acquisition subsystems are described. Author

N78-24611*# RHO Sigma, Inc., North Hollywood, Calif.

PRELIMINARY DESIGN PACKAGE FOR RS600 MICROPROCESSOR CONTROL SUBSYSTEM

1978 15 p Prepared for DOE

(Contract NAS8-32256)

(NASA-CR-150628) Avail: NTIS HC A02/MF A01 CSCL 10A

Microprocessor control subsystems developed for use in heating, heating and cooling, and/or hot water systems for single family, multi-family, or commercial applications are described.

Author

N78-24612*# Sunkeeper Control Corp., Andover, Mass.

PRELIMINARY DESIGN PACKAGE FOR PROGRAMMABLE CONTROLLER AND HYDRONIC ENERGY PACKAGE

Apr. 1978 36 p Prepared for DOE

(Contract NAS8-32257)

(NASA-CR-150629) Avail: NTIS HC A03/MF A01 CSCL 10A

Information necessary to evaluate the preliminary design of the sunkeeper controller is presented as a compilation of the following documents: development plan, verification plan, hazard analysis, drawing list, and other information pertaining to the design of the subsystem. Author

N78-24613*# Wyle Labs., Inc., Huntsville, Ala. Solar Energy Systems Div.

INDOOR TEST FOR THERMAL PERFORMANCE EVALUATION ON THE SUNWORKS (AIR) SOLAR COLLECTOR

Jan. 1978 34 p refs Prepared for DOE

(Contract NAS8-32036)

(NASA-CR-150666; WYLE-TR-531-17) Avail: NTIS HC A03/MF A01 CSCL 10A

The test procedure used and the results obtained from an evaluation test program conducted to obtain thermal performance data on a Sunworks single glazed air solar collector under simulated conditions are described. A time constant test and incident angle modifier test were conducted to determine the transient effect and the incident angle effect on the collector. These results and the results of the collector load test are also discussed. Author

N78-24614*# Wyle Labs., Inc., Huntsville, Ala. Solar Energy Systems Div.

OUTDOOR THERMAL EFFICIENCY EVALUATION OF THE YING SOLAR COLLECTOR

14 Mar. 1978 17 p ref Revised Prepared for DOE

(Contract NAS8-32036)

(NASA-CR-150675; WYLE-TR-531-21-Rev-A) Avail: NTIS HC A02/MF A01 CSCL 10A

The test procedure used and the test results obtained during an evaluation test program to obtain thermal efficiency performance data are presented. The flat plate collector used water/prestone antifreeze solution as the working fluid. Author

N78-24615*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

WAKE CHARACTERISTICS OF AN EIGHT-LEG TOWER FOR A MOD-0 TYPE WIND TURBINE

Joseph M. Savino, Lee H. Wagner, and Donald Sinclair Dec. 1977 70 p refs

(Contract E(49-26)-1028)

(NASA-TM-73868; E-9463; DOE/NASA/1028-77/14) Avail: NTIS HC A04/MF A01 CSCL 10B

Low speed wind tunnel tests were conducted to determine the flow characteristics of the wake downwind of a 1/25th scale, all tubular eight leg tower concept suitable for application to the DOE-NASA MOD-0 wind power turbine. Measurements were made of wind speed profiles, and from these were determined the wake local minimum velocity, average velocity, and width for several wind approach angles. These data are presented herein along with tower shadow photographs and comparisons with data from an earlier lattice type, four leg tower model constructed of tubular members. Values of average wake velocity defect ratio and average ratio of wake width to blade radius for the eight leg model were estimated to be around 0.17 and 0.30, respectively, at the plane of the rotor blade. These characteristics suggest that the tower wake of the eight leg concept is slightly less than that of the four leg design. Author

N78-24616*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RAPID, EFFICIENT CHARGING OF LEAD-ACID AND NICKEL-ZINC TRACTION CELLS

John J. Smithrick 1978 9 p refs To be presented at the 13th Intersoc. Energy Conversion Eng. Conf., San Diego, Calif., 20-25 Aug. 1978

(Contract EC-77-A-31-1011)

(NASA-TM-78901; E-9637; DOE/NASA/1011-78/26) Avail: NTIS HC A02/MF A01 CSCL 10C

Lead-acid and nickel-zinc traction cells were rapidly and efficiently charged using a high rate tapered direct current (HRTDC) charge method which could possibly be used for on-the-road service recharge of electric vehicles. The HRTDC method takes advantage of initial high cell charge acceptance and uses cell gassing rate and temperature as an indicator of charging efficiency. On the average, in these preliminary tests, 300 amp-hour nickel-zinc traction cells were given a HRTDC (initial current 500 amps, final current 100 amps) to 78 percent of rated amp-hour capacity within 53 minutes at an amp-hour

efficiency of 92 percent and an energy efficiency of 52 percent. Three hundred amp-hour lead-acid traction cells were charged to 69 percent of rated amp-hour capacity within 46 minutes at an amp-hour efficiency of 91 percent with an energy efficiency of 64 percent. In order to find ways to further decrease the recharge times, the effect of periodically (0 to 400 Hz) pulse discharging cells during a constant current charging process (94% duty cycle) was investigated. Preliminary data indicate no significant effect of this type of pulse discharging during charge on charge acceptance of lead-acid or nickel-zinc cells. Author

N78-24617*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIMINIODE THERMIONIC ENERGY CONVERSION WITH LANTHANUM-HEXABORIDE ELECTRODES
Erich W. Kroeger, Virginia L. Bair, and James F. Morris 1978 18 p refs Presented at the International Conference on Plasma Science, Monterey, Calif., 15-18 May 1978; sponsored by IEEE
(NASA-TM-78887; E-9622) Avail: NTIS HC A02/MF A01 CSCL 10A

Thermionic conversion data obtained from a variable gap cesium diminiode with a hot pressed, sintered lanthanum hexaboride emitter and an arc melted lanthanum hexaboride collector are presented. Performance curves cover a range of temperatures: emitter 1500 to 1700 K, collector 750 to 1000 K, and cesium reservoir 370 to 510 K. Calculated values of emitter and collector work functions and barrier index are also given. Author

N78-24618*# Institute of Gas Technology, Chicago, Ill.
MOLTEN SALT THERMAL ENERGY STORAGE SYSTEMS Final Report
Hansraj C. Maru, John F. Dullea, Alan Kardas, Larry Paul, Leonard G. Marianowski, Estela Ong, Viji Sampath, Vincent M. Huang, and Jerome C. Wolak Mar. 1978 129 p refs Sponsored by NASA
(Contract EY-76-C-02-2888; Proj. 8981)
(NASA-CR-135419; COO-2888-3) Avail: NTIS HC A07/MF A01 CSCL 10C

The feasibility of storing thermal energy at temperatures of 450 C to 535 C in the form of latent heat of fusion was examined for over 30 inorganic salts and salt mixtures. Alkali carbonate mixtures were chosen as phase-change storage materials in this temperature range because of their relatively high storage capacity and thermal conductivity, moderate cost, low volumetric expansion upon melting, low corrosivity, and good chemical stability. Means of improving heat conduction through the solid salt were explored. Author

N78-24619# Joint Economic Committee (U. S. Congress).
THE IMPACT OF THE PRESIDENT'S ENERGY PLAN ON THE NORTHEAST
Washington GPO 1977 138 p refs Hearing before the Subcomm. on Energy of the Joint Economic Comm., 95th Congr., 1st Sess., 13 May 1977
(GPO-97-013) Avail: SOD HC

Conversion from oil to coal, transportation of coal, gasoline consumption targets, incentives for development of solar energy, and energy-efficient homes, electrical appliances, and automobiles are considered in terms of the regional economic impact of the national energy plan. Emphasis is placed on establishing equity of energy costs among regions. J.M.S.

N78-24620*# Solarex Corp., Rockville, Md.
DEVELOPMENT OF A HIGH EFFICIENCY THIN SILICON SOLAR CELL Final Report
Joseph Lindmayer and Charles Y. Wrigley Sep. 1977 98 p Prepared for JPL
(Contracts NAS7-100; JPL-954290)
(NASA-CR-157078; SX/105/F) Avail: NTIS HC A05/MF A01 CSCL 10A

A key to the success of this program was the breakthrough development of a technology for producing ultra-thin silicon slices which are very flexible, resilient, and tolerant of moderate handling abuse. Experimental topics investigated were thinning technology, gaseous junction diffusion, aluminum back alloying, internal reflectance, tantalum oxide anti-reflective coating optimization, slice flexibility, handling techniques, production rate limiting steps, low temperature behavior, and radiation tolerance. Author

N78-24621*# Battelle Columbus Labs., Ohio.
MEASUREMENT TECHNIQUES AND INSTRUMENTS SUITABLE FOR LIFE-PREDICTION TESTING OF PHOTOVOLTAIC ARRAYS Interim Report
G. T. Noel, F. A. Sliemers, G. C. Deringer, V. E. Wood, K. E. Wilkes, G. B. Gaines, and D. C. Carmichael 15 Jan. 1978 198 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954328)
(NASA-CR-157084; DOE/JPL-954328-78/1) Avail: NTIS HC A09/MF A01 CSCL 10A

Array failure modes, relevant materials property changes, and primary degradation mechanisms are discussed as a prerequisite to identifying suitable measurement techniques and instruments. Candidate techniques and instruments are identified on the basis of extensive reviews of published and unpublished information. These methods are organized in six measurement categories - chemical, electrical, optical, thermal, mechanical, and other physicals. Using specified evaluation criteria, the most promising techniques and instruments for use in life prediction tests of arrays were selected. Author

N78-24622*# Westinghouse Electric Corp., Pittsburgh, Pa.
SILICON MATERIALS TASK OF THE LOW COST SOLAR ARRAY PROJECT, PHASE 2 Quarterly Report, 1 Oct. - 31 Dec. 1977
R. H. Hopkins, J. R. Davis, Jr., P. D. Blais, A. Rohatgi, P. Rai-Choudhury, M. H. Hanes, and J. R. McCormick (Dow Corning Corp., Midland, Mich.) 31 Dec. 1977 96 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954331)
(NASA-CR-157082; DOE/JPL-954431-78/1; QR-9) Avail: NTIS HC A05/MF A01 CSCL 10A

The object of phase 2 of this program is to investigate and define the effects of various processes, contaminants and process-contaminant interactions in the performance of terrestrial solar cells. The major effort this quarter was in the areas of crystal growth and thermal processing, comparison of impurity effects in low and high resistivity silicon, modeling the behavior of p-type ingots containing Mo, and C and, quantitative analysis of bulk lifetime and junction degradation effects in contaminated solar cells. The performance of solar cells fabricated on silicon web crystals grown from melts containing about 10 to the 18th power/cu cm of Cr, Mn, Fe, Ni, Ti, and V, respectively were measured. Deep level spectroscopy of metal-contaminated ingots was employed to determine the level and density of recombination centers due to Ti, V, Ni, and Cr. Author

N78-24623*# Union Carbide Corp., New York.
LOW COST SILICON SOLAR ARRAY PROJECT SILICON MATERIALS TASK: ESTABLISHMENT OF THE FEASIBILITY OF A PROCESS CAPABLE OF LOW-COST, HIGH VOLUME PRODUCTION OF SILANE (STEP 1) AND THE PYROLYSIS OF SILANE TO SEMICONDUCTOR-GRADE SILICON (STEP 2) Quarterly Progress Report, Jul. - Sep. 1977
W. C. Breneman, E. G. Farrier, and J. Rexer Sep. 1977 37 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954334)
(NASA-CR-157100; QPR-8; DOE/JPL-954334-77/4) Avail: NTIS HC A03/MF A01 CSCL 10A

Extended operation of a small process-development unit routinely produced high quality silane in 97+% yield from dichlorosilane. The production rate was consistent with design loadings for the fractionating column and for the redistribution reactor. A glass fluid-bed reactor was constructed for room temperature operation. The behavior of a bed of silcon particles was observed as a function of various feedstocks, component configurations, and operating conditions. For operating modes other than spouting, the bed behaved in an erratic and unstable manner. A method was developed for casting molten silicon powder into crack-free solid pellets for process evaluation. The silicon powder was melted and cast into thin walled quartz tubes that sacrificially broke on cooling. Author

N78-24624*# Union Carbide Corp., New York.
LOW COST SILICON SOLAR ARRAY PROJECT SILICON

MATERIALS TASK: ESTABLISHMENT OF THE FEASIBILITY OF A PROCESS CAPABLE OF LOW-COST, HIGH VOLUME PRODUCTION OF SILANE (STEP 1) AND THE PYROLYSIS OF SILANE TO SEMICONDUCTOR-GRADE SILICON (STEP 2) Quarterly Progress Report, Oct. - Dec. 1977
W. C. Breneman, H. Cheung, E. G. Farrier, and H. Morihara Dec. 1977 78 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954334)
(NASA-CR-157101; QPR-9; DOE/JPL-954334-78/5) Avail: NTIS HC A05/MF A01 CSCL 10A

A quartz fluid bed reactor capable of operating at temperatures of up to 1000 C was designed, constructed, and successfully operated. During a 30 minute experiment, silane was decomposed within the reactor with no pyrolysis occurring on the reactor wall or on the gas injection system. A hammer mill/roller-crusher system appeared to be the most practical method for producing seed material from bulk silicon. No measurable impurities were detected in the silicon powder produced by the free space reactor, using the cathode layer emission spectroscopic technique. Impurity concentration followed by emission spectroscopic examination of the residue indicated a total impurity level of 2 micrograms/gram. A pellet cast from this powder had an electrical resistivity of 35 to 45 ohm-cm and P-type conductivity. Author

N78-24625*# Battelle Columbus Labs., Ohio.
EVALUATION OF SELECTED CHEMICAL PROCESSES FOR PRODUCTION OF LOW-COST SILICON, PHASE 2 Quarterly Progress Report, 1 Jul. - 30 Sep. 1977
J. M. Blocher, Jr., M. F. Browning, W. J. Wilson, and D. C. Carmichael 20 Oct. 1977 44 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954339)
(NASA-CR-157076; QPR-8; ERDA/JPL-954339-77/8) Avail: NTIS HC A03/MF A01 CSCL 10A

The miniplant was operated to provide 2.2 kg of product for evaluation, evaluate methods of product withdrawal, and test three zinc vaporizer concepts. Results of the zinc vaporizer tests were consistent with concurrent heat transfer calculations. Work was continued on the electrolysis of synthetic Zn/ZnCl2 mixtures to develop base line experience for comparison with the results of planned experiments with miniplant by product containing suspended silicon and zinc. Author

N78-24626*# Battelle Columbus Labs., Ohio.
EVALUATION OF SELECTED CHEMICAL PROCESSES FOR PRODUCTION OF LOW-COST SILICON, PHASE 2. SILICON MATERIAL TASK, LOW-COST SILICON SOLAR ARRAY PROJECT Quarterly Progress Report, 1 Oct. - 31 Dec. 1977
J. M. Blocher, Jr., M. F. Browning, Erlan E. Rose, William B. Thompson, William A. Schmitt, James S. Fippin, Richard W. Kidd, C. Y. Liu, Pamela S. Kerbler, W. R. Ackley (Katzen (Raphael) Associates) et al 20 Jan. 1978 39 p Sponsored in part by ERDA Prepared for JPL
(Contracts NAS7-100; JPL-954339)
(NASA-CR-157073; DOE/JPL-954339-78/9; QPR-3) Avail: NTIS HC A03/MF A01 CSCL 10A

Progress from October 1, 1977, through December 31, 1977, is reported in the design of the 50 MT/year experimental facility for the preparation of high purity silicon by the zinc vapor reduction of silicon tetrachloride in a fluidized bed of seed particles to form a free flowing granular product. Author

N78-24627*# Honeywell Corporate Material Sciences Center, Bloomington, Minn.
DIP-COATING PROCESS: SILICON SHEET GROWTH DEVELOPMENT FOR THE LARGE-AREA SILICON SHEET TASK OF THE LOW-COST SILICON SOLAR ARRAY PROJECT Quarterly Report, 20 Sep. - 27 Nov. 1977
J. D. Zook, J. D. Heaps, R. B. Maciolek, B. Koepke, C. D. Gutter, and S. B. Schuldt 30 Dec. 1977 59 p refs Sponsored in part by ERDA Prepared for JPL
(Contracts NAS7-100; JPL-954356)
(NASA-CR-157072; ERDA/JPL-954356-77/4; HONEYWELL-QR-7) Avail: NTIS HC A04/MF A01 CSCL 10A

The objective of this research program is to investigate the technical and economic feasibility of producing solar-cell-quality sheet silicon by coating one surface of carbonized ceramic substrates with a thin layer of large-grain polycrystalline silicon from the melt. The past quarter demonstrated significant progress in several areas. Seeded growth of silicon-on-ceramic (SOC) with an EFG ribbon seed was demonstrated. Different types of mullite were successfully coated with silicon. A new method of deriving minority carrier diffusion length, L sub n from spectral response measurements was evaluated. ECOMOD cost projections were found to be in good agreement with the interim SAMIS method proposed by JPL On the less positive side, there was a decrease in cell performance which we believe to be due to an unidentified source of impurities. Author

N78-24628*# Crystal Systems, Inc., Salem, Mass.
HEAT EXCHANGER METHOD: INGOT CASTING. FIXED ABRASIVE METHOD: MULTI-WIRE SLICING. PHASE 2 OF SILICON SHEET GROWTH DEVELOPMENT FOR THE LARGE AREA SILICON SHEET TASK OF THE LOW COST SILICON SOLAR ARRAY PROJECT Quarterly Progress Report, 21 Nov. - 31 Dec. 1977
Frederick Schmid and Chandra P. Khattak 6 Jan. 1978 24 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954373)
(NASA-CR-157081; DRL-58-DRD-SE-7; DOE/JPL-954373-77/5; QPR-1) Avail: NTIS HC A02/MF A01 CSCL 10A

An attemp was made to cast a square cross section ingot to achieve high packing density of solar cells in the module with maximum material utilization. Although some minor cracking occurred, it appeared feasible to cast square section ingots by the heat exchanger method. Author

N78-24629*# Varian Associates, Lexington, Mass. Vacuum Div.
SLICING OF SILICON INTO SHEET MATERIAL. SILICON SHEET GROWTH DEVELOPMENT FOR THE LARGE AREA SILICON SHEET TASK OF THE LOW COST SILICON SOLAR ARRAY PROJECT Quarterly Report, 19 Sep. - 17 Dec. 1977
S. C. Holden and J. R. Fleming 12 Jan. 1978 118 p Sponsored in part by ERDA Prepared for JPL
(Contracts NAS7-100; JPL-954374)
(NASA-CR-157080; ERDA/JPL-954374-77/4; QR-7) Avail: NTIS HC A06/MF A01 CSCL 10A

Fabrication of a prototype large capacity multiple blade slurry saw is considered. Design of the bladehead which will tension up to 1000 blades, and cut a 45 cm long silicon ingot as large as 12 cm in diameter is given. The large blade tensioning force of 270,000 kg is applied through two bolts acting on a pair of scissor toggles, significantly reducing operator set-up time. Tests with an upside-down cutting technique resulted in 100% wafering yields and the highest wafer accuracy yet experienced with MS slicing. Variations in oil and abrasives resulted only in degraded slicing results. A technique of continuous abrasive slurry separation to remove silicon debris is described. Author

N78-24630*# Motorola, Inc., Phoenix, Ariz.
LASER-ZONE GROWTH IN A RIBBON-TO-RIBBON (RTR) PROCESS. SILICON SHEET GROWTH DEVELOPMENT FOR THE LARGE AREA SILICON SHEET TASK OF THE LOW COST SILICON SOLAR ARRAY PROJECT Technical Quarterly Report No. 6, 10 Oct. - 31 Dec. 1977
R. W. Gurtler, A. Baghdadi, R. Legge, B. Sopori, and R. J. Ellis 31 Dec. 1977 106 p Prepared for JPL
(Contracts NAS7-100; JPL-954376)
(DOE/JPL-954376-78/1; Rept-2256/8) Avail: NTIS HC A06/MF A01 CSCL 10A

The Ribbon-to-Ribbon (RTR) approach to silicon ribbon growth is investigated. An existing RTR apparatus is to be upgraded to its full capabilities and operated routinely to investigate and optimize the effects of various growth parameters on growth results. A new RTR apparatus was constructed to incorporate increased capabilities and improvements over the first apparatus and to be capable of continuous growth. New high power lasers were implemented and this led to major improvements in growth velocity -- 4 inch/min. growth has been demonstrated. A major step in demonstration of the full feasibility of the RTR process

is reported in the demonstration of RTR growth from CVD polyribbon rather than sliced polyribbon ingots. Average solar cell efficiencies of greater than 9% and a best cell efficiency of 11.7% are reported. Processing was shown to provide a substantial improvement in material minority carrier diffusion length. An economic analysis is reported which treats both the polyribbon fabrication and RTR processes. Author

N78-24631*# Motorola, Inc., Phoenix, Ariz.
SEMICONDUCTOR GRADE, SOLAR SILICON PURIFICATION PROJECT Technical Quarterly Report, 1 Oct. - 31 Dec. 1977
William M. Ingle, Stephen Thompson, Dick Rosler, and John Jackson 21 Dec. 1977 41 p Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954442)
(NASA-CR-157064; DOE/JPL-954442-78/1; Rept-2257/8; TRP-8) Avail: NTIS HC A03/MF A01 CSCL 10A

The conversion of metallurgical grade silicon into semiconductor grade silicon by way of a three step SiF2 polymer transport purification process was investigated. Developments in the following areas were also examined: (1) spectroscopic analysis and characterization of (SiF2) sub x polymer and Si sub x F sub y homologue conversion; (2) demonstration runs on the near continuous apparatus; (3) economic analysis; and (4) elemental analysis. Author

N78-24632*# Rockwell International Corp., Anaheim, Calif. Autonetics Strategic Systems Div.
ACCELERATED/ABBREVIATED TEST METHODS, STUDY 4 OF TASK 3 (ENCAPSULATION) OF THE LOW-COST SILICON SOLAR ARRAY PROJECT Quarterly Progress Report, Oct. - Dec. 1977
J. M. Kolyer and N. R. Mann 3 Jan. 1978 17 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954458)
(NASA-CR-157087; ERDA/JPL-954458-77/8; QPR-7) Avail: NTIS HC A02/MF A01 CSCL 10A

Inherent weatherability is controlled by the three weather factors common to all exposure sites: insolation, temperature, and humidity. Emphasis was focused on the transparent encapsulant portion of miniature solar cell arrays by eliminating weathering effects on the substrate and circuitry (which are also parts of the encapsulant system). The most extensive data were for yellowing, which were measured conveniently and precisely. Considerable data also were obtained on tensile strength. Changes in these two properties after outdoor exposure were predicted very well from accelerated exposure data. Author

N78-24633*# RCA Labs., Princeton, N. J. Materials and Processing Research Lab.
SILICON SHEET GROWTH BY THE INVERTED STEPANOV TECHNIQUE Final Report, 22 Mar. 1976 - 31 May 1977
K. M. Kim, S. Berkman, M. T. Duffy, A. E. Bell, H. E. Temple, and G. W. Cullen Jun. 1977 95 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954465)
(NASA-CR-157088; PRRL-77-CR-22; DOE/JPL-954465-77/2) Avail: NTIS HC A05/MF A01 CSCL 10A

The feasibility of growing silicon ribbons by the inverted ribbon growth process was established using both nonwetting boron nitride (BN) dies as well as wetting composite dies coated with chemically vapor deposited silicon nitride. The former can be termed as the inverted Stepanov process, the latter as the inverted edge defined film fed growth (EFG) process. Flat die and V-shaped crucible die configurations were employed. The V-shaped susceptor was modified to decrease the vertical gradient inside the susceptor in order to minimize the SiO formation and the related hysteresis. In an effort to improve pinning the meniscus at the die edge, three different die designs were used. A pressure differential was also applied across the melt in an effort to suppress the hysteresis. Various types of thermal trimmers were used in an attempt to provide suitable thermal gradients at the solid liquid ribbon growth interface. Although real progress was made, the instabilities were suppressed sufficiently to allow for initiation of ribbon growth. Author

N78-24634*# SRI International Corp., Menlo Park, Calif.
NOVEL DUPLEX VAPOR-ELECTROCHEMICAL METHOD FOR SILICON SOLAR CELLS Quarterly Progress Report, 1 Aug. - 31 Oct. 1977
Vijay K. Kapur, Leonard Nanis, and Angel Sanjurjo Dec. 1977 29 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954471; SRI Proj. PYU-4980)
(NASA-CR-157090; ERDA/JPL-954471-77/4; QPR-7) Avail: NTIS HC A03/MF A01 CSCL 10A

Silicon obtained by the SiF4-Na reaction was analyzed by spark source mass spectrometry (SSMS). Silicon samples prepared from induction melted powder were evaluated for electrical properties using four point probe conductivity and thermoelectric methods. SiF4-Na reaction under P sub SiF4 greater than 1 atmosphere. The amount of silicon produced was increased from 25 g per batch (in the glass reactor) to greater than 70 g per batch in the stainless steel reactor. The study of the effects of reaction variables such as P sub SiF4 and maximum temperature attained on the particle size of silicon powder showed that the silicon particle size tends to grow larger with increasing pressure of the SiF4 gas in the reaction system. Author

N78-24635*# Spire Corp., Bedford, Mass.
INTEGRAL GLASS ENCAPSULATION FOR SOLAR ARRAYS Interim Report, May 1976 - Jul. 1977
Pete R. Young Nov. 1977 90 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954521)
(NASA-CR-157091; DOE/JPL-954521-77/3; IR-10046-1) Avail: NTIS HC A05/MF A01 CSCL 10A

Electrostatic bonding has been used to join silicon solar cells to borosilicate glass without the aid of any organic binders or adhesives. The results of this investigation have been to demonstrate, without question, the feasibility of this process as an encapsulation technique. The potential of ESB for terrestrial solar arrays was clearly shown. The process is fast, reproducible, and produces a permanent bond between glass and silicon that is stronger than the silicon itself. Since this process is a glass sealing technique requiring no organics it makes moisture tight sealing of solar cells possible. Author

N78-24636*# Springborn Labs., Inc., Enfield, Conn.
INVESTIGATION OF TEST METHODS, MATERIAL PROPERTIES, AND PROCESSES FOR SOLAR CELL ENCAPSULANTS. ENCAPSULATION TASK OF THE LOW-COST SILICON SOLAR ARRAY PROJECT Quarterly Progress Report, 12 Aug. - 12 Nov. 1977
Nov. 1977 46 p Sponsored in part by ERDA Prepared for JPL
(Contracts NAS7-100; JPL-954527; JPL Proj. 6072.1)
(NASA-CR-157149; ERDA/JPL-954527-77/4) Avail: NTIS HC A03/MF A01 CSCL 10A

During this quarter, flat-plate solar collector systems were considered and six basic construction elements were identified: outer coatings, superstrates, pottants, substrates, undercoats, and adhesives. Materials surveys were then initiated to discover either generic classes or/and specific products to function as each construction element. Cost data included in the surveys permit ready evaluation of each material. Silicones, fluorocarbons, glass, and acrylic polymers have the highest inherent weatherability of materials studied to date. Only acrylics, however, combine low costs, environmental resistance, and potential processability. This class will receive particular emphasis. Author

N78-24637*# Dow Corning Corp., Midland, Mich. Solid State Research and Development Lab.
SOLAR SILICON VIA THE DOW CORNING PROCESS Quarterly Report
L. P. Hunt, V. D. Dosaj, and J. R. McCormick Jan. 1978 17 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954559)
(NASA-CR-157065; DOE/JPL-954559-78/1; QR-6) Avail: NTIS HC A09/MF A01 CSCL 10A

Carbon, as a reductant for quartz, must be made available so as to have suitable reactivity in conjunction with high purity, especially with respect to boron and phosphorus. A detailed experimental plan was developed to do this. Different sources of carbon were selected to be subjected to various purification

methods and reactivity-enhancement processes. A developmental scale arc furnace was installed to perform quartz-carbon reactivity testing. Author

N78-24638*# AeroChem Research Labs., Inc., Princeton, N. J.
SYNTHESIS OF SILANE AND SILICON IN A NON-EQUILIBRIUM PLASMA JET Quarterly Report
H. F. Calcote and W. Felder Dec. 1977 41 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954560)
(NASA-CR-157067; AeroChem-TN-181) Avail: NTIS HC A03/MF A01 CSCL 10A

The feasibility of using a non-equilibrium hydrogen plasma jet as a chemical synthesis tool was investigated. Four possible processes were identified for further study: (1) production of polycrystalline silicon photovoltaic surfaces, (2) production of $SiHCl_3$ from $SiCl_4$, (3) production of SiH_4 from $SiHCl_3$, and (4) purification of $SiCl_4$ by metal impurity nucleation. The most striking result was the recognition that the strongly adhering silicon films, amorphous or polycrystalline, produced in our studies could be the basis for preparing a photovoltaic surface directly; this process has potential advantages over other vapor deposition processes. Author

N78-24639*# Solarex Corp., Rockville, Md.
SILICON SOLAR CELLS WITH A TOTAL POWER CAPACITY OF 30 KILOWATTS Final Technical Report
31 Oct. 1977 17 p Revised Sponsored by NASA Prepared for JPL
(Contract JPL-954577)
(NASA-CR-157066) Avail: NTIS HC A02/MF A01 CSCL 10A

The bulk of the contract effort was carried out in the following two phases: Phase 1 -- module design, Pre-production module fabrication, inspection and test. Phase 2 -- Production, test and delivery. Effort during the first two months of the contract concentrated on design of a solar module to meet specification. Basic module design resulting from this effort is as follows: (1) frame design; (2) cell pan design; (3) cell interconnection; (4) encapsulation; (5) electrical performance. Author

N78-24640*# Westinghouse Electric Corp., Trafford, Pa. Power Circuit Breaker Div.
LOW COST SILICON SOLAR ARRAY PROJECT SILICON MATERIALS TASK Quarterly Technical Report, Jul. - Sep. 1977
Sep. 1977 35 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954589)
(NASA-CR-157092; ERDA/JPL-954589-77/3) Avail: NTIS HC A03/MF A01 CSCL 10A

A program was established to develop a high temperature silicon production process using existing electric arc heater technology. Silicon tetrachloride and a reductant will be injected into an arc heated mixture of hydrogen and argon. Under these high temperature conditions, a very rapid reaction is expected to occur and proceed essentially to completion, yielding silicon and gaseous sodium chloride. Techniques for high temperature separation and collection of the molten silicon will be developed using standard engineering approaches, and the salt vapor will later be electrolytically separated into its elemental constituents for recycle. Preliminary technical evaluations and economic projections indicate not only that this process appears to be feasible, but that it also has the advantages of rapid, high capacity production of good quality molten silicon at a nominal cost. Author

N78-24641*# RCA Labs., Princeton, N. J.
EPITAXIAL SILICON GROWTH FOR SOLAR CELLS Quarterly Report
R. V. Daiello, P. H. Robinson, and D. Richman Jan. 1978 22 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954817)
(NASA-CR-157093; ERDA/JPL-954817-78/1; QR-1) Avail: NTIS HC A02/MF A01 CSCL 10A

Growth and fabrication procedures for the baseline solar cells are described along with measured cell parameters, and the results. Reproducibility of these results was established and the direction to be taken for higher efficiency is identified. Author

N78-24642*# Solarex Corp., Rockville, Md.
ENERGY REQUIREMENT FOR THE PRODUCTION OF SILICON SOLAR ARRAYS Quarterly Report, 21 Jun. - 20 Sep. 1977
Joseph Lindmayer, Manfred Wihl, and Alan Scheinine Oct. 1977 73 p refs Sponsored in part by ERDA Prepared for JPL
(Contracts NAS7-100; JPL-954606)
(NASA-CR-157074; SX/111/3; ERDA/JPL-954606-77/3; QR-3) Avail: NTIS HC A04/MF A01 CSCL 10A

Refinement techniques are assessed in terms of their energy demands. It is found that all of them are potentially acceptable alternatives to the conventional silane process. Refinement technologies reviewed include: (1) pure silicon via the metallic reduction of silicon tetrahalides; (2) synthesis of silane for solar grade silicon by means of catalytic redistribution of chlorosilanes; (3) refined silicon via a silicon fluoride polymer transport process; and (4) purified silicon from upgraded conventional arc furnace processes. It is shown that the current development of these refinement processes would yield payback times in the range of 0.2 to 1.2 years if a 12.5% efficient cell could be achieved. Compared to the conventional process which is characterized by a payback time of 3.2 years these technologies appear to be endowed with the potential to provide the silicon necessary for energy demands. Author

N78-24643*# Solarex Corp., Rockville, Md.
ENERGY REQUIREMENT FOR THE PRODUCTION OF SILICON SOLAR ARRAYS Final Report, 21 Sep. - 20 Dec. 1977
Joseph Lindmayer, Manfred Wihl, Alan Scheinine, Thomas Rosenfield, Charles Y. Wrigley, Andrew Morrison, Jack Anderson, Anthony Clifford, and Wendell Lafky Dec. 1977 146 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954606)
(NASA-CR-157071; SX/111/4; ERDA/JPL-954606-77/4) Avail: NTIS HC A07/MF A01 CSCL 10A

The results of a study to investigate the feasibility of manufacturing photovoltaic solar array modules by the use of energy obtained from similar or identical photovoltaic sources are presented. The primary objective of this investigation was the characterization of the energy requirements of current and developing technologies which comprise the photovoltaic field. For cross-checking the energies of prevailing technologies data were also used and the wide-range assessment of alternative technologies included different refinement methods, various ways of producing light sheets, semicrystalline cells, etc. Energy data are utilized to model the behavior of a future solar breeder plant under various operational conditions. Author

N78-24644*# General Electric Co., Philadelphia, Pa. Space Div.
DEVELOPMENT AND TESTING OF SHINGLE-TYPE SOLAR CELL MOLECULES Quarterly Report
N. F. Shepard 5 Jan. 1978 53 p Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954607)
(NASA-CR-157094; DOE/JPL-954607-78/1; QR-2) Avail: NTIS HC A04/MF A01 CSCL 10A

The details of a shingle module design which produces in excess of 97 watts/sq m of module area at 1 kW/sq m insolation and at 60 C are reported. This selected design employs a tempered glass coverplate to provide the primary solar cell structural support. The fabrication and testing of a preproduction module of this design has demonstrated that this selected approach will meet the environmental testing requirements imposed by the contract. Author

N78-24645*# Syncal Corp., Sunnyvale, Calif.
SOLAR THERMOELECTRIC GENERATORS Final Report
29 Jul. 1977 96 p Prepared for JPL
(Contract JPL-954637)
(NASA-CR-157097) Avail: NTIS HC A05/MF A01 CSCL 10A

The methods, the findings and the conclusions of a study for the design of a Solar Thermoelectric Generator (STG) intended for use as a power source for a spacecraft orbiting the planet Mercury are discussed. Several state-of-the-art thermoelectric technologies in the intended application were considered. The

design of various STG configurations based on the thermoelectric technology selected from among the various technologies was examined in detail and a recommended STG design was derived. The performance characteristics of the selected STG technology and associated design were studied in detail as a function of the orbital characteristics of the STG in Mercury and throughout the orbit of Mercury around the sun. Author

N78-24646*# Westinghouse Electric Corp., Philadelphia, Pa. Research and Development Center.
SILICON WEB PROCESS DEVELOPMENT Quarterly Report, 1 Jul. - 30 Sep. 1977
C. S. Duncan, R. G. Seidensticker, J. P. McHugh, P. D. Blais, and J. R. Davis, Jr. 30 Sep. 1977 73 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954654)
(NASA-CR-157098; ERDA/JPL-954654-77/2; QR-2) Avail: NTIS HC A04/MF A01 CSCL 10A

Thirty-five (35) furnace runs were carried out during this quarter, of which 25 produced a total of 120 web crystals. The two main thermal models for the dendritic growth process were completed and are being used to assist the design of the thermal geometry of the web growth apparatus. The first model, a finite element representation of the susceptor and crucible, was refined to give greater precision and resolution in the critical central region of the melt. The second thermal model, which describes the dissipation of the latent heat to generate thickness-velocity data, was completed. Dendritic web samples were fabricated into solar cells using a standard configuration and a standard process for a N(+) -P-P(+) configuration. The detailed engineering design was completed for a new dendritic web growth facility of greater width capability than previous facilities. Author

N78-24647*# Eagle-Picher Industries, Inc., Joplin, Mo. Couples Dept.
PRELIMINARY INVESTIGATION OF A SEALED, REMOTELY ACTIVATED SILVER-ZINC BATTERY Final Report
Carroll G. Wheat 7 Sep. 1977 33 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954768)
(NASA-CR-157132; Rept-1026-77-1) Avail: NTIS HC A03/MF A01 CSCL 10C

Methods necessary to provide a remotely activated, silver zinc battery capable of an extended activated stand while in a sealed condition were investigated. These requirements were to be accomplished in a battery package demonstrating an energy density of at least 35 watt hours per pound. Several methods of gas suppression were considered in view of the primary nature of this unit and utilized the electroplated dendritic zinc electrode. Amalgamation of the electrode provided the greatest suppression of gas at the zinc electrode. The approach to extending the activated stand capability of the remotely activated battery was through evaluation of three basic methods of remote, multi-cell activation; 1) the electrolyte manifold, 2) the gas manifold and 3) the individual cell. All three methods of activation can be incorporated into units which will meet the minimum energy density requirement. Author

N78-24648*# AeroChem Research Labs., Inc., Princeton, N. J.
SILICON HALIDE-ALKALI METAL FLAMES AS A SOURCE OF SOLAR GRADE SILICON Quarterly Report, 1 Sep. - 30 Nov. 1977
W. J. Miller Dec. 1977 18 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954777)
(NASA-CR-157133; AeroChem-TN-182; QR-2) Avail: NTIS HC A02/MF A01 CSCL 10A

The experimental effort on this program has concentrated thus far on Na/SiCl4 and K/SiCl4 opposed jet diffusion flames in an evacuated reaction vessel; both reactants are supplied as vapors. The flames are self-igniting, fast burning and intensely chemiluminescent. Solid reaction products were collected, separated by simple washing, and some preliminary analyses performed which indicate that the concentrations of most impurities in the reagents are reduced during the course of the Si formation process. The chen.iluminescence is being characterized spectroscopically. The products of reaction are all solids and appear as a mixture of brown (amorphous Si) and white (KCl) powders. Microscopic examination of the unwashed products reveals what seem to be agglomerates of Si particles with less than 1 micron diameter. Washing with slightly acidic water easily removes the KCl. Author

N78-24649*# Optical Coating Lab., Inc., City of Industry, Calif. Photoelectronics Div.
HIGH EFFICIENCY, LONG LIFE TERRESTRIAL SOLAR PANEL Quarterly Report, 1 Sep. - 30 Nov. 1977
T. Chao, S. Khemthong, R. Ling, and S. Olah 30 Nov. 1977 26 p Sponsored in part DOE Prepared for JPL
(Contracts NAS7-100; JPL-954831)
(NASA-CR-157060; DOE/JPL-954831-77/12; QR-1) Avail: NTIS HC A03/MF A01 CSCL 10A

The design of a high efficiency, long life terrestrial module was completed. It utilized 256 rectangular, high efficiency solar cells to achieve high packing density and electrical output. Tooling for the fabrication of solar cells was in house and evaluation of the cell performance was begun. Based on the power output analysis, the goal of a 13% efficiency module was achievable. Author

N78-24650*# Spectrolab, Inc., Sylmar, Calif.
ARRAY AUTOMATED ASSEMBLY, PHASE 2 Quarterly Report
William E. Taylor Feb. 1978 65 p refs Sponsored by NASA and DOE Prepared for JPL
(Contract JPL-954853)
(NASA-CR-157057; DOE/JPL-954853-78/1) Avail: NTIS HC A04/MF A01 CSCL 10A

An analysis was made of cost tradeoffs for shaping modified square wafers from cylindrical crystals. Tests were conducted of the effectiveness of texture etching for removal of surface damage on sawed wafers. A single step texturing etch appeared adequate for removal of surface damage on wafers cut with multiple blade reciprocating slurry saws. Author

N78-24651*# Sensor Technology, Inc., Chatsworth, Calif.
ARRAY AUTOMATED ASSEMBLY TASK LOW COST SILICON SOLAR ARRAY PROJECT, PHASE 2 Quarterly Technical Report, Oct. - Dec. 1977
Gregory T. Jones Jan. 1978 28 p Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954865)
(NASA-CR-157059; QTR-1; DOE/JPL-954865-78/1) Avail: NTIS HC A03/MF A01 CSCL 10A

An automated process sequence was defined, process steps were organized into groups for investigation, and data was gathered and analysis begun for four process groups. A solar cell test data acquisition system was designed. This system will automatically sample and plot the electrical performance of solar cells and will also be adaptable for solar cell module electrical performance. Wafer surface preparation equipment has been modified for this automation program. The equipment is now ready to process 90 mm diameter silicon wafers in sample volume for a projected automated process analysis. The laser trimming and holing operation was defined. Author

N78-24652*# Coors Porcelain Co., Golden, Colo.
DEVELOPMENT OF MULLITE SUBSTRATES AND CONTAINERS. SILICON SHEET GROWTH DEVELOPMENT FOR THE LARGE AREA SILICON SHEET TASK OF THE LOW-COST SILICON SOLAR ARRAY PROJECT Quarterly Report, 6 Oct. - 14 Nov. 1977
D. G. Wirth and J. D. Sibold 5 Dec. 1977 18 p Sponsored in part by NASA and DOE Prepared for JPL
(Contract JPL-954878)
(NASA-CR-157104; QR-1) Avail: NTIS HC A02/MF A01 CSCL 10A

Eight mullite bodies of varied compositions and microstructures were prepared. These compositions will be submerged in molten silicon to study the impurity and surface effects. Low cost processing methods are being developed and evaluated for manufacturing large mullite sheets and mullite containers. At present, a state-of-the-art roll compaction process has shown promising initial results for substrates. Author

N78-24653*# Texas Instruments, Inc., Dallas.
AUTOMATED ARRAY ASSEMBLY, PHASE 2 Quarterly Technical Progress Report

Bernard G. Carbajal Jan. 1978 29 p Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954881)
(NASA-CR-157134; TI-03-77-56; DOE/JPL-954881-78-1; QTPR-4) Avail: NTIS HC A03/MF A01 CSCL 10A

This contract includes solar cell module process development activities in the areas of surface preparation, plasma processing, diffusion, cell processing and module fabrication. In addition, a High Efficiency Cell Development Activity is included. The overall goal is to advance solar cell module process technology to meet the 1986 goal of a production capacity of 500 megawatts per year at a cost of less than $500 per kilowatt. This contract will focus on the process element developments stated above and will propose an overall module process. During this quarter, effort was concentrated on wafer etching for saw damage removal, establishing a standard phosphorous diffusion process and a baseline solar cell process as a test bed, designing a large area square cell including test sites, analyzing module layouts for optimum packing efficiency and fabricating the first Tandem Junction Cells (TJC) for this contract. A TJC with backside contacts gave 15.1% efficiency at AM1. Author

N78-24654*# Solarex Corp., Rockville, Md.
DEVELOPMENT OF AN IMPROVED HIGH EFFICIENCY THIN SILICON SOLAR CELL Quarterly Report
Joseph Lindmayer et al Jan. 1978 17 p Prepared for JPL
(Contracts NAS7-100; JPL-954883)
(NASA-CR-157058; Sx/115/1Q) Avail: NTIS HC A02/MF A01 CSCL 10A

Efforts were concerned with optimizing techniques for thinning silicon slices in NaOH etches, initial investigations of surface texturing, variation of furnace treatments to improve cell efficiency, initial efforts on optimization of gridline and cell sizes and Pilot Line fabrication of quantities of 2 cm x 2 cm 50 micron thick cells. Author

N78-24655*# Varian Associates, Lexington, Mass. Vacuum Div.
DEVELOPMENT OF ADVANCED METHODS FOR CONTINUOUS CZOCHRALSKI GROWTH. SILICON SHEET GROWTH DEVELOPMENT FOR THE LARGE AREA SILICON SHEET TASK OF THE LOW COST SILICON SOLAR ARRAY PROJECT Quarterly Progress Report, 4 Oct. - 30 Dec. 1977
R. G. Wolfson and C. B. Sibley 11 Jan. 1978 31 p Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954884)
(NASA-CR-157056; DOE/JPL-954884-77/4; QPR-1) Avail: NTIS HC A03/MF A01 CSCL 10A

The three components required to modify the furnace for batch and continuous recharging with granular silicon were designed. The feasibility of extended growth cycles up to 40 hours long was demonstrated by a recharge simulation experiment; a 6 inch diameter crystal was pulled from a 20 kg charge, remelted, and pulled again for a total of four growth cycles, 59-1/8 inch of body length, and approximately 65 kg of calculated mass. Author

N78-24656*# Simat, Helliesen and Eichner, Inc., Newton Center, Mass.
LSSA LARGE AREA SILICON SHEET TASK: CONTINUOUS LIQUID FEED CZOCHRALSKI GROWTH Quarterly Report, Oct. - Dec. 1977
Walter Torbet Jan. 1978 15 p Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954886)
(NASA-CR-157135; DOE/JPL-954886-78/1; Rept-0140-0080) Avail: NTIS HC A02/MF A01 CSCL 10A

The development of a Czochralski furnace that permits the growing of silicon crystals with a continuous liquid replenishment of the molten silicon of the growth crucible is described. Author

N78-24657*# Schumacher (J. C.) Co., Oceanside, Calif.
HIGH VELOCITY CONTINUOUS-FLOW REACTOR FOR THE PRODUCTION OF SOLAR GRADE SILICON Quarterly Report, 24 Oct. - 24 Dec. 1977
L. Woerner Dec. 1977 41 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954914)
(NASA-CR-157068; ERDA/JPL-954914-77/1; QR-1) Avail: NTIS HC A03/MF A01 CSCL 10A

The feasibility of a high volume, high velocity continuous reduction reactor as an economical means of producing solar grade silicon was tested. Bromosilanes and hydrogen were used as the feedstocks for the reactor along with preheated silicon particles which function both as nucleation and deposition sites. A complete reactor system was designed and fabricated. Initial preheating studies have shown the stability of tetrabromosilane to being heated as well as the ability to preheat hydrogen to the desired temperature range. Several test runs were made and some silicon was obtained from runs carried out at temperatures in excess of 1180 K. Author

N78-24658*# Old Dominion Univ. Research Foundation, Norfolk, Va.
LONG-TERM RADIATION EFFECTS ON GaAs SOLAR CELL CHARACTERISTICS Final Report, 1 Jun. 1977 - 31 May 1978
John H. Heinbockel and M. J. Doviak May 1978 77 p refs (Grant NsG-1426)
(NASA-CR-157151) Avail: NTIS HC A05/MF A01 CSCL 10A

This report investigates preliminary design considerations which should be considered for a space experiment involving Gallium Arsenide (GaAs) solar cells. The electron radiation effects on GaAs solar cells were conducted in a laboratory environment, and a statistical analysis of the data is presented. In order to augment the limited laboratory data, a theoretical investigation of the effect of radiation on GaAs solar cells is also developed. The results of this study are empirical prediction equations which can be used to estimate the actual damage of electrical characteristics in a space environment. The experimental and theoretical studies also indicate how GaAs solar cell parameters should be designed in order to withstand the effects of electron radiation damage. Author

N78-24659*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS) Summary Report
Sep. 1977 101 p refs Sponsored in part by NSF
(Contract E(49-18)-1751)
(NASA-TM-73871; E-8596) Avail: NTIS HC A06/MF A01 CSCL 10A

ECAS compared various advanced energy conversion systems that can use coal or coal-derived fuels for baseload electric power generation. It was conducted in two phases. Phase 1 consisted of parametric studies. From these results, 11 concepts were selected for further study in Phase 2. For each of the Phase 2 systems and a common set of ground rules, performance, cost, environmental intrusion, and natural resource requirements were estimated. In addition, the contractors defined the state of the associated technology, identified the advances required, prepared preliminary research and development plans, and assessed other factors that would affect the implementation of each type of powerplant. The systems studied in Phase 2 include steam systems with atmospheric- and pressurized-fluidized-bed boilers; combined cycle gas turbine/steam systems with integrated gasifiers or fired by a semiclean, coal derived fuel; a potassium/steam system with a pressurized-fluidized-bed boiler; a closed-cycle gas turbine/organic system with a high-temperature, atmospheric-fluidized-bed furnace; a direct-coal-fired, open- cycle magnetohydrodynamic/steam system; and a molten-carbonate fuel cell/steam system with an integrated gasifier. The sensitivity of the results to changes in the ground rules and the impact of uncertainties in capital cost estimates were also examined.
Author

N78-24660*# National Aeronautics and Space Administration, Washington, D. C.
PATENT APPLICATION. VARIABLE-VOLUME ENGINE
Stephane Convers May 1978 12 p Transl. into ENGLISH from French Patent no. 77-35813, 9 Nov. 1977 8 p Transl. by SCITRAN, Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75094) Avail: NTIS HC A02/MF A01 CSCL 10A

A description is given of an engine using the expansion-contraction of bodies subjected to controlled thermal variations and making use of free natural heat sources. Author

N78-24661# Committee on Energy and Natural Resources (U. S. Senate).
PETROLEUM INDUSTRY INVOLVEMENT IN ALTERNATIVE SOURCES OF ENERGY
Washington GPO 1977 395 p refs Rept. for Subcomm. on Energy Res. and Development of the Comm. on Energy and Natural Resources, 95th Congr., 1st Sess., Sep. 1977
(GPO-93-800; Publ-95-54) Avail: Subcomm. on Energy Res. and Development

Information from the public record about the nonpetroleum resource holdings and research and development activities of the nation's oil companies is presented. Resources considered are coal, oil shale, geothermal, and uranium. Author

N78-24662# Committee on Energy and Natural Resources (U. S. Senate).
SOLAR ENERGY
Washington GPO 1977 406 p refs Joint hearing before the Subcomm. on Energy Production and Supply and the Subcomm. on Energy Res. and Development of the Comm. on Energy and Natural Resources and the Select Comm. on Small Business, 95th Congr., 1st Sess., 1 Jun. 1977
(GPO-94-910; Publ-95-65) Avail: Subcomm. on Energy Production and Supply

Testimony was presented to provide important perspectives on solar energy, particularly as related to small businesses. Means of encouraging optimum commercial development of all the alternative energy industries were discussed. Discussion centered around the opportunities and problems facing small businesses in the emerging alternative energy industries. Institutional and economic barriers to commercialization and dissemination of alternative energy products and services were outlined and the role of government in promoting commercial development was discussed. P.R.A.

N78-24663# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHODS OF OBTAINING MAXIMUM ELECTRICAL POWER IN SHORT PULSES
M. V. Babykin and A. V. Bartov 14 Dec. 1977 41 p refs Transl. into ENGLISH of Rept. IAE-2253 Institute Atomnoy Energii, Moscow, 1972 p 1-24
(AD-A051746; FTD-ID(RS)T-2035-77) Avail: NTIS HC A03/MF A01 CSCL 20/9

The purpose of this work is to examine the question, what determines the maximum powers and rate of increase in the power of various systems and under what conditions can parameters be obtained which are necessary for the initiation of a thermonuclear reaction. Here, we will consider only the final stages of energy accumulators which are able to create power pulses shorter than 10 to the -7th - 10 to the -8th s. All the slower sources of energy such as, for example, explosion-magnetic generators which can ensure a current pulse no shorter than 5-10 microsec will not be examined here although they, along with regular capacitor batteries and inductive and electromagnetic accumulators, can be used as preliminary sources of energy for fast systems and their comparative evaluation unquestionably will be necessary in the future. GRA

N78-24664# Little (Arthur D.), Inc., Cambridge, Mass.
PRELIMINARY DESIGN OF A 10 kWe SOLAR HEATED OPEN BRAYTON-CYCLE ENGINE, PHASE 1 Final Report
Nov. 1977 76 p refs
(Contract N68305-76-C-0014; YE5751999)
(AD-A051101; ADL-C-79516-F; CEL-CR-78.003) Avail: NTIS HC A05/MF A01 CSCL 13/1

This report discusses the results of the first phase of a two-phase program to assess the applicability of electric power generation from solar energy at Naval bases, particularly advanced bases which require small, mobile systems not under development in the civilian sector. For purposes of establishing a baseline system against which the costs and benefits of various solar-to-electric energy conversion processes can be compared, an open-cycle air turbine/generator set was chosen with tracking parabolic dish reflector to focus direct solar radiation onto a collector/heat exchanger providing heat for the engine. GRA

N78-24665# Boston Univ., Mass. Dept. of Chemistry.
PHOTOISOMERIZATION OF BIS 9-ANTHRYL METHANE AND OTHER LINKED ANTHRACENES: THE ROLE OF EXCIMERS AND BIRADICALS IN PHOTODIMERIZATION Technical Report, 1 Nov. 1976 - 31 Dec. 1977
William R. Bergmark, Guilford Jones, II, Thomas E. Reinhardt, and Arthur M. Halpern 1 Mar. 1978 43 p refs
(Contract N00014-76-C-0442)
(AD-A051336; TR-7) Avail: NTIS HC A03/MF A01 CSCL 07/3

A series of linked anthracenes capable of storing photon energy through endoergic valence photo-isomerization have been studied. Photophysical and photochemical characteristics of the systems have been completely characterized by measurement of fluorescence quantum yields and lifetimes, and efficiencies for forward and reverse isomerization. The release of energy stored in photoisomers has been measured using kinetic and calorimetric techniques. From emission and lifetime data the respective roles of excimers and biradicals in anthracene photodimerization have been defined. Author (GRA)

N78-24666# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTER PROGRAM FOR DESIGN AND PERFORMANCE ANALYSIS OF NAVIGATION-AID POWER SYSTEMS, PROGRAM SUMMARY Final Report
H. Weiner Jun. 1977 117 p refs
(Contract MIPR-Z-70099-5-53355A; MIPR-Z-70099-5-50352)
(AD-A047890; JPL-5040-27; USCG-D-11-77) Avail: NTIS HC A06/MF A01 CSCL 09/2

A computer program developed for the performance analysis of a spacecraft power system is capable of performing all the calculations necessary to understand the overall characteristics of solar array-battery power systems for application to aids to navigation. The DSPA (Design Synthesis/Performance Analysis) Computer Program will enable the Coast Guard to design solar array/battery power systems for aids to navigation having any specific flashing lamp load and at any geographical location, simulate the performance of solar array/battery power systems in operation on navigation aids under specific flashing lamp load and environmental conditions, and provide specifications for viable alternative designs which may be used to integrate solar array/battery power systems into the Coast Guard inventory. The DSPA Computer Program was verified by comparing the predicted operational characteristics of specified power systems with the actual performance of these same power systems. The Computer Program accurately predicted the changes in battery state-of-charge over a one year period for two power systems considered successfully tested by the Coast Guard. GRA

N78-24667# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTER PROGRAM FOR DESIGN AND PERFORMANCE ANALYSIS OF NAVIGATION-AID POWER SYSTEMS PROGRAM DOCUMENTATION. VOLUME 2: USER'S MANUAL Final Report
G. Goltz and H. Weiner Jul. 1977 102 p
(Contract MIPR-Z-70099-5-50352)
(AD-A047356; JPL-5040-27-Vol-2-Change-1; USCG-D-11-77-Vol-2; CGR/DC-18/76-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 09/2

A computer program has been developed for designing and analyzing the performance of solar array/battery power systems for the U.S. Coast Guard Navigational Aids. This program is called the Design Synthesis/Performance Analysis (DSPA) Computer Program. The basic function of the Design Synthesis portion of the DSPA program is to evaluate functional and economic criteria to provide specifications for viable solar array/battery power systems. The basic function of the Performance Analysis portion of the DSPA program is to simulate the operation of solar array/battery power systems under specific loads and environmental conditions. This document provides all the information necessary to access the DSPA programs, to input required data and to generate appropriate Design Synthesis or Performance Analysis Output. GRA

N78-24668# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTER PROGRAM FOR DESIGN AND PERFORMANCE ANALYSIS OF NAVIGATION-AID POWER SYSTEMS PROGRAM DOCUMENTATION. VOLUME 3: PROGRAMMER'S MANUAL Final Report
G. Goltz and H. Weiner Jul. 1977 171 p
(Contract MIPR-Z-70099-5050352)
(AD-A047542; JPL-5040-27-Vol-3-Change-1; USCG-D-11-77-Vol-3; CGR/DC-18/76-Vol-3) Avail: NTIS HC A08/MF A01 CSCL 10/2

A computer program has been developed for designing and analyzing the performance of solar array/battery power systems for the U.S. Coast Guard Navigational Aids. This program is called the Design Synthesis/Performance Analysis (DSPA) Computer Program. The basic function of the Design Synthesis portion of the DSPA program is to evaluate functional and economic criteria to provide specifications for viable solar array/battery power systems. The basic function of the Performance Analysis portion of the DSPA program is to simulate the operation of solar array/battery power systems under specific loads and environmental conditions. This document provides a detailed description of the DSPA Computer Program system and its subprograms. This manual will assist the programmer in revising or updating the several subprograms. GRA

N78-24669# Thermo Electron Corp., Waltham, Mass.
THERMODYNAMIC ANALYSIS OF A TIN-STEAMED LMMHD SYSTEM Final Technical Report
29 Jul. 1977 60 p ref
(Contract N00014-77-C-0523)
(AD-A052395; TE5471-10-78) Avail: NTIS HC A04/MF A01 CSCL 10/2

In this report, we evaluate the thermodynamic analyses and data of a tin-steam liquid metal magnetohydrodynamic power system proposed by Argonne National Laboratory, Argonne, Illinois, to the Office of Naval Research, Washington, D.C. Our evaluations consisted of: (1) an analysis of the ideal or limiting performance of the proposed system; (2) a comparison of the results obtained by means of a computer model developed by Argonne with those obtained by simplified hand calculations by Thermo Electron Corporation; (3) an analysis of the sensitivities of the computer results to the values of key but uncertain input parameters; (4) an analysis of the major efficiency losses in the system; and (5) a comparison of the proposed system with one that does not use magnetohydrodynamics but does require effective steam heat management (reheat and feedwater heating). Author (GRA)

N78-24670# Engelhard Minerals and Chemicals Corp., Murray Hill, N.J. Engelhard Industries Div.
FUEL CELL BATTERIES FOR OPERATION OF AIDS TO NAVIGATION Final Report
Oct. 1977 43 p refs
(Contract DOT-CG-43144-A)
(AD-A052574; USCG-D-83-77; CGR/DC-30/77) Avail: NTIS HC A03/MF A01 CSCL 10/2

A program for the development of air-breathing fuel cell batteries for the operation of aids to navigation is discussed. Calcium hydride is used as fuel. The fuel cell batteries provide a significantly higher energy density than conventional power sources. The development focuses on a battery system suitable for U.S. Coast Guard requirements. Modules with a capacity of 6KWH and a nominal rating of 2 watts at 13 volts are being developed. Design and evaluation of single cells and battery modules are discussed. Testing is performed mostly with a U.S. Coast Guard flasher using a 1.15A lamp. The program discussed in this report is a first step towards the development of hydride-based fuel cell batteries for use with aids to navigation. The development effort carried out so far has confirmed the suitability of the hydride cell for the design of high energy density batteries. Additional work is requred, however, to arrive at applicable hardware. Author (GRA)

N78-24671# Naval Research Lab., Washington, D. C. Plasma Physics Div.
COUPLING OF IMPLODING-PLASMA LOADS TO HIGH-POWER GENERATORS Interim Report
David Mosher Jan. 1978 20 p refs
(RR0110941)
(AD-A052575, AD-E000129; NRL-MR-3687) Avail: NTIS HC A02/MF A01 CSCL 20/9

A simple analytic model for the implosion of annular plasma loads driven by high-power pulse line generators is presented. Tabulations of imploded-plasma parameters as a function of dimensionless variables characterizing the generator and load are presented and can be used to characterize the efficiency of energy transfer between generator and load and the final plasma state. These results are used to compare optimal load configurations for the three pulse-duration options of the Proto II accelerator. Author (GRA)

N78-24672# Energy Research and Development Administration, Albuquerque, N. Mex.
SOLAR TOTAL ENERGY SYSTEM, LARGE SCALE EXPERIMENT, SHENANDOAH, GEORGIA. VOLUME 2, SECTION 3: FACILITY CONCEPT DESIGN Final Technical Progress Report
17 Oct 1977 193 p refs Prepared in cooperation with Stearns-Roger Corp., Denver, Colo. and McDonnell Douglas Corp., St. Louis, Mo.
(Contract EG-77-C-04-3987)
(ALO/3987-1/2-Vol-2) Avail: NTIS HC A09/MF A01

A large scale experiment to design, construct, test, evaluate, and operate a solar total energy system (STES) for the purpose of obtaining experience with large scale hardware systems and to establish engineering capability for subsequent demonstration projects is described. The solar total energy system is sized to supply 1.720 MW thermal power and 383.6 kW electrical power. The STES is sized for the extended knitwear plant of 3902 M2 (42,000 sq-ft) which will eventually employ 300 people. Conceptual design requirements of the facility are presented. Facility concept design, system concept design, performance analysis, operation plan, component and subsystem development, procurement plan, cost estimating and scheduling, and technical and management plans are among the topics discussed. ERA

N78-24673# Energy Research and Development Administration, Albuquerque, N. Mex.
SOLAR TOTAL ENERGY SYSTEM, LARGE SCALE EXPERIMENT, SHENANDOAH, GEORGIA, VOLUME 3 Final Technical Progress Report
17 Oct. 1977 124 p Prepared in cooperation with Stearns-Roger Corp., Denver, Colo. and McDonnell Douglas Corp., St. Louis, Mo.
(Contract EG-77-C-04-3987)
(ALO/3987-1/3-Vol-3) Avail: NTIS HC A06/MF A01
For abstract, see N78-24672.

N78-24674*# Thermo Electron Corp., Waltham, Mass.
ERDA/NASA ADVANCED THERMIONIC TECHNOLOGY PROGRAM Progress Report
May 1977 24 p refs
(Contracts NAS3-20302; EY-76-C-02-3056)
(NASA-CR-157117; PR-23; TE-4217/4220-140-77; COO-3056-25) Avail: NTIS HC A02/MF A01 CSCL 10A

Research progress is outlined in the areas of surface studies (basic experiments and direct beam chamber), plasma studies (converter theory and advanced mode conversion experiments), component development (low-temperature and high-temperature converter experiments), and component hardware (hot shell development). ERA

N78-24675# Battelle Columbus Labs., Ohio.
AGGLOMERATING BURNER GASIFICATION PROCESS: DESIGN, INSTALLATION, AND OPERATION OF A 25-TON-A-DAY PROCESS DEVELOPMENT UNIT Monthly Progress Report
8 Sep. 1977 18 p
(Contract EX-76-C-01-1513)
(FE-1513-64) Avail: NTIS HC A02/MF A01

Extensive solids circulation tests were completed and a correlation relating solids circulation rate to pressure loss in the vertical riser was developed. Efforts to complete an integrated gasification run were retarded by failure of a section of steel pipe in the solids transfer line and failure of portions of the combustor distributor plate. Fabrication of the erosion test rig

was completed and made ready for hot-gas calibration. Activity on the turbine engineering study is presented. ERA

N78-24676# Brookhaven National Lab., Upton, N. Y.
SOME RATE AND MODELING STUDIES ON THE USE OF IRON-TITANIUM HYDRIDE AS AN ENERGY STORAGE MEDIUM FOR ELECTRIC UTILITY COMPANIES
Gerald Strickland and Wen-Shi Yu 26 Apr. 1977 62 p refs
(Contract EY-76-C-02-0016)
(BNL-50667) Avail: NTIS HC A04/MF A01

Dynamic tests and modeling studies were made on the chemical energy storage portion of an electrical energy conversion and storage system proposed for leveling the load of an electric utility company. The concept utilizes off-peak power to produce hydrogen by electrolyzing water, storing the hydrogen as iron-titanium hydride, FeTiH/sub x/, and subsequently, releasing the hydrogen to a fuel cell where the reaction with air generates electrical power. ERA

N78-24677# Institute of Gas Technology, Chicago, Ill.
OPTIMIZATION STUDY OF OTEC DELIVERY SYSTEMS BASED ON CHEMICAL-ENERGY CARRIERS Final Report
Alex J. Konopka, Abu Talib, Bernard Yudow, and Nicholas Biederman Dec. 1976 331 p refs Sponsored in part by DoE
(Contract NSF C-1008; Grant NSF AER-75-00033)
(ERDA/NSF/00033-76/TI) Avail: NTIS HC A15/MF A01

The technoeconomic feasibility of chemical energy carriers was studied. The chemical energy carriers analyzed were hydrogen, as a gas and as a liquid, and liquid ammonia. Designs of systems for producing and transporting chemical energy to shore were completed. Estimates of the cost at which chemical energy would be available from an onshore terminal were prepared. A technical and economic evaluation of conversion delivered ammonia to ammonium nitrate and urea was completed and a general analysis of chemical energy reconverted into electricity onshore was also made. The information for the major project tasks--production, transmission, terminaling, and conversion back to electricity--is given. ERA

N78-24678# Los Alamos Scientific Lab., N. Mex.
GAS STIMULATION STUDIES AT LASL
W. J. Carter, B. W. Olinger, N. E. Vanderborgh, and T. E. Springer 1977 27 p refs Presented at the 3d Ann. ERDA Symp. on Enhanced Oil and Gas Recovery, Tulsa, Okla., 30 Aug. - 1 Sep. 1977
(Contract W-7405-eng-36)
(LA-UR-77-1937; Conf-770836-5) Avail: NTIS HC A03/MF A01

Hugoniots, dynamic spall strengths, wave profiles on shock and release, and ultrasonic elastic constants were determined as functions of material density and bedding orientation for Devonian shales. These data form the basis of predictive explosive stimulation technology. Weapons-developed shaped charges using heavy metal liners are investigated for downhole use in order to produce a horizontal manifold system leading to a central borehole. Applications of the paths produced by these devices include intersection of the natural fracture patterns, explosive or chemical emplacement, or producing hydrofractures displaced from the borehole. Laser pyrolysis studies showed that pulsed laser heating results in a rapid deposition of precise quantities of thermal energy into selected shale volumes. Such laser-induced pyrolysis forms the basis for a rapid assay technique which can be used at the wellhead or as a downhole logging tool. Finally a computational technique using a hybrid (analog and digital) computer is being developed with the ultimate objective of simulating proposed extraction technologies to establish optimum economic stimulation methods. ERA

N78-24679# Pittsburgh and Midway Coal Mining Co., Merrian, Kans.
SOLVENT REFINED COAL (SRC) PROCESS Monthly Report
Sep. 1977 15 p
(Contract EX-76-C-01-0496)
(FE-496-138) Avail: NTIS HC A02/MF A01

The progress of the SRC project for the month of July 1977 is reported. A blend of Kentucky 9 and 14 coal was processed and a material balance run was completed. ERA

N78-24680# Pittsburgh Univ., Pa.
MEASUREMENT OF THE FLOW PROPERTIES AND CAPILLARY PRESSURE RELATIONSHIPS OF CERTAIN COALS PERTAINING TO UNDERGROUND COAL GASIFICATION Quarterly Report, Mar. - May 1977
P. F. Fulton and A. A. Reznik Jun. 1977 40 p
(Contract EY-76-S-02-4129)
(COO-4129-3) Avail: NTIS HC A03/MF A01

Measurement of the absolute permeability to gas, porosity, and effective and relative permeability to gas of the Pittsburgh bituminous coal and the Hanna, Wyoming subbituminous coal was extended. The same measurements were made on several samples from the Gillette, Wyoming subbituminous coal. Shrinkage of both coals with drying was also measured. The gas relative permeability curves of the coals are compared and the difference is striking. The rate of increase in permeability to gas past the critical gas saturation is significantly greater as the rank of the coal decreases. Similarly values of absolute permeability, shrinkage, and porosity are inverse functions of rank. The critical gas saturation does not appear to be a function of rank. ERA

N78-24681# Union Carbide Corp., Tonawanda, N.Y.
OCEAN THERMAL POWER PLANTS HEAT EXCHANGERS Final Report
A. M. Czikk, C. F. Fails, G. W. Fenner, D. L. McLaughlin, and R. Zawierucha 21 May 1976 150 p refs
(Contract EX-76-C-01-2448)
(ERDA/NSF/43441-76/1) Avail: NTIS HC A07/MF A01

The cycle considered herein is a closed Rankine system, in which a working fluid (ammonia or propane) is evaporated and condensed in heat exchange with the seawater streams. The cost-performance characteristics of OTEC heat exchangers were studied. Corrosion, biofouling, and material selection were discussed in great detail. In order to decrease the exchanger cost, the use of heat transfer enhancement were studied, including a nucleation promoter for the evaporator, a surface tension motivated condensate film-thinner for the condenser, and boundary layer turbulence promoters for the seawater flows. The heat exchangers can only be optimized as part of the entire plant, as a system, in order to properly apportion temperature differences between the evaporator, condenser, and turbine, and to make optimum choice of the internal power consumptions. An optimization program was written and used to obtain the optimum systems designs. ERA

N78-24682# Booz-Allen and Hamilton, Inc., Bethesda, Md. Booz, Allen Applied Research Div.
PRELIMINARY DEPENDENCY ANALYSIS FOR PROGRAM EVALUATION
Mar. 1977 32 p
(Contract EX-76-C-01-2343)
(FE-2343-14-1) Avail: NTIS HC A03/MF A01

A generic dependency chart was developed as a framework for analysis of certain types of key planning problems. An early application of dependency network methodology to a specific problem, such as the planned atmospheric fluidized bed combustion demonstration plant project, was recommended. ERA

N78-24683# Battelle Pacific Northwest Labs., Richland, Wash.
CHARACTERIZATION OF SUBSTANCES IN PRODUCTS, EFFLUENTS AND WASTES FROM SYNTHETIC FUEL DEVELOPMENT PROCESSES Quarterly Report, 1976
J. S. Fruchter, M. R. Petersen, and P. W. Ryan Jan. 1977 15 p
(Contract EY-76-C-06-1830)
(BNWL-2224; QR-4) Avail: NTIS HC A02/MF A01

Constituents occurring in products, effluents, and emissions from the technology processes that warrant consideration in the development of control measures were identified and quantified. ERA

N78-24684# Brookhaven National Lab., Upton, N. Y.
SYNTHESIS AND PROPERTIES OF USEFUL METAL HYDRIDES. A REVIEW OF RECENT WORK AT BROOKHAVEN NATIONAL LABORATORY

J. J. Reilly Aug. 1977 32 p refs Presented at Intern. Symp. on Hydrides for Energy Storage, Geilo, Norway, 14 Aug. 1977
(Contract EY-76-C-02-0016)
(BNL-23047; Conf-770823-3) Avail: NTIS HC A03/MF A01

The reaction of hydrogen with intermetallic compounds was investigated. Alloy systems of interest for hydrogen storage discussed include: Mg-Cu, Mg-Ni, Fe-Ti, and Ti-Cu. The properties of their corresponding hydrides are reviewed. ERA

N78-24685# Sandia Labs., Albuquerque, N. Mex.
PHYSICS UNDERLYING IMPROVED EFFICIENCY OF HIGH-LOW-JUNCTION EMITTER SILICON SOLAR CELLS
J. G. Fossum, F. A. Lindholm (Florida Univ., Gainesville), and C. T. Sah (Illinois Univ., Urbana) 1977 4 p refs Presented at IEEE Intern. Electron Devices Meeting, Wash., D. C., 5 Dec. 1977
(Contract EY-76-C-04-0789)
(SAND-77-1610C; Conf-771201-6) Avail: NTIS HC A02/MF A01

The physical behavior of a HLE solar cell, that yields substantial increases in the open-circuit voltage and in the power-conversion efficiency of p-n junction silicon solar cells, is described. The structure differs from the conventional cell structure (n+-n-p) in that it contains a high-low (H-L) junction in the emitter (n+-p). For cells having low base resistivities (approximately 0.1 ohm cm), efficiency improvements of about 15 percent at AM1 and about 40 percent at 50 suns can be expected. The improvement at 50 suns results in an efficiency of about 20 percent at 27 C. ERA

N78-24686# Sandia Labs., Albuquerque, N. Mex.
MODAL ANALYSIS OF THE FIRST PRODUCTION DESIGN HELIOSTAT USED AT THE SOLAR THERMAL TEST FACILITY (STTF)
John R. Janczy Sep. 1977 122 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1393) Avail: NTIS HC A06/MF A01

Dynamic modal characteristics of a heliostat to be used at a solar thermal test facility are studied. Two studies were conducted of the yoke and one on the facet assembly. During the course of the test, power spectra density studies were performed using wind-loading and transport environmental data. The modal (frequency, damping and stiffness) data are presented. The data obtained through the various studies compared favorably. The data indicates a possible structural modification, and this modification is discussed. ERA

N78-24687# Oak Ridge National Lab., Tenn.
ANALYSIS OF ALKALI METAL BOILER FOR FLUIDIZED BED APPLICATIONS
R. L. Graves Nov. 1977 43 p refs
(Contract W-7405-eng-26)
(ORNL-TM-6016) Avail: NTIS HC A03/MF A01

The analytical methods used to determine the operating characteristics of alkali metal boilers coupled specifically to fluidized bed furnaces are detailed. Calculation methods are provided for both natural circulation boilers used with deep beds and horizontal tube, forced circulation boilers used in conjunction with shallow fluidized beds. Typical steady-state operating characteristics for boilers of both types being investigated in conjunction with the ORNL alkali metal topping cycle study are provided also. ERA

N78-24688# Aerospace Engineering Office, Zurich (Switzerland).
STUDY OF TEST METHODS FOR LARGE FLEXIBLE SOLAR ARRAYS (VELSA) Final Report
C. R. Vincent, K. J. Zimmermann, and H.-R. Luessi Paris ESA Jul. 1977 276 p refs Prepared jointly with Pilatus Aircraft Ltd.
(Contract ESTEC 2990/76-NL-HP(SC))
(ESA-CR(P)-1016) Avail: NTIS HC A13/MF A01

Methods and means to predict and verify the dynamic on-orbit characteristics of large flexible solar arrays are discussed. The actual status is given by surveys of available computer programs, recent correlation work, test facilities, and test methods. Required verification tests are listed and, in the outline of particular tests, the gravity effects are checked. Analytical methods investigated for the prediction of the dynamic characteristics take into account material and geometrical nonlinearities as well as thermal transient loads. Algorithms for the correlation of the mathematical model to test results are discussed. Based on cost estimates, feasibility of tests and analytical aspects, suitable verification programs are elaborated for both stowed and deployed configurations. Considering test priorities, a reduced cost program is set up in parallel. The accuracy in the prediction of the solar array dynamic characteristics is mainly improved by a logic sequence of tests starting at component level and following various assembly stages as well as by the correlation of the mathematical model.
Author (ESA)

N78-24689# National Technical Information Service, Springfield, Va.
PETROLEUM EXPLORATION, PRODUCTION, AND RECOVERY METHODS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Feb. 1978
Audrey S. Hundemann Mar. 1978 189 p Supersedes NTIS/PS-77/0231; NTIS/PS-75/254
(NTIS/PS-78/0277; NTIS/PS-77/0231; NTIS/PS-75/254)
Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 08G

Various methods of oil recovery such as water flooding, gas flooding, steam flooding, and thermal recovery methods are discussed in this bibliography of Federally-funded research. Also included are methods used in prospecting for oil and predicting oil recovery; production processes and costs; and mining and petroleum laws of various countries. Offshore drilling and recovery are not included. GRA

N78-24690# Resources for the Future, Inc., Washington, D. C.
THE ENERGY/REAL GROSS DOMESTIC PRODUCT RATIO: AN ANALYSIS OF CHANGES DURING THE 1966-1970 PERIOD IN RELATION TO LONG-RUN TRENDS
Jack Alterman Oct. 1977 92 p refs
(PB-277235; BEA/SP-77/30) Avail: NTIS HC A05/MF A01 CSCL 10A

The factors underlying the 1966-1970 reversal in the long term decline in the BTU/GDP ratio were analyzed. In attempting to place the 1966-1970 reversal in a longer term perspective, it was found that there had been a slowdown in the secular rate of decline in the ratio since 1929, culminating in the most recent period, between 1966 and 1975, when there was a net increase in the ratio. As a result, the study was broadened to include an analysis of some of the factors underlying the reduction in the long term rate of decline in the BTU/GDP ratio and the connection, if any, between the 1966-1970 reversal and the slowdown in the secular rate. Author

N78-24237*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT OF A UNIFIED CRITERION FOR SOLAR COLLECTOR SELECTION
F. L. Lansing *In its* The Deep Space Network 15 Apr. 1978 p 224-235 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 10A

N78-24239*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PERFORMANCE OF SOLAR-POWERED VAPOR-JET REFRIGERATION SYSTEMS WITH SELECTED WORKING FLUIDS
V. W. Chai and F. L. Lansing *In its* The Deep Space Network 15 Apr. 1978 p 245-251 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 10A

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N78-24691# Air Force Systems Command, Wright-Patterson AFB, Ohio.
APPLICATION OF CHEMILUMINESCENCE ANALYSIS IN AIR POLLUTION RESEARCH
Chen Chu Cheun 30 Dec. 1977 23 p refs Transl. into ENGLISH from Huaxue Tongbao, (China), no. 4, 1976 p 30-36
(AD-A052549; FTD-ID(RS)T-2152-77) Avail: NTIS

HC A02/MF A01 CSCL 13/2

The technique of chemiluminescence as applied to air pollutant detection is described. Advantages of the technique are given. Topics discussed include: (1) chemiluminescence reaction of ozone and rhodamine B; (2) gas phase chemiluminescence reaction of ozone and ethylene; (3) gas phase chemiluminescence reaction of ozone and nitrogen monoxide; and (4) flame chemiluminescence of nitrogen monoxide, sulfur dioxide, and hydrogen sulfide. J.M.S.

N78-24692# Environmental Research Lab., Gulf Breeze, Fla.
KEPONE ACCUMULATION, TRANSFER, AND LOSS THROUGH ESTUARINE FOOD CHAINS Final Report
Lowell H. Bahner, Alfred J. Wilson, James M. Sheppard, James M. Patrick, Larry R. Goodman, and Gerald E. Walsh 1977 10 p
(PB-277183; EPA-600/J-77-074) Avail: NTIS HC A02/MF A01 CSCL 13B

Accumulation, transfer, and loss of Kepone in estuarine organisms were studied in laboratory bioassays. Kepone was bioconcentrated by oysters (Crassostrea virginica), mysids (Mysidopsis bahia), grass shrimp (Palaemonetes pugio), sheep shead minnows (Cyprinodon variegatus), and spot (Leiostomus xanthurus), from concentrations as low as 0.023 micrograms/1 seawater. Bioconcentration factors ranged from 10 to 340 in static exposures and 900 to 13,500 in flow-through bioassays, and were dependent on species and exposure duration. Depuration of Kepone from oysters in Kepone-free water was rapid (35 percent loss in 24 hours); however, depuration of Kepone was slow in crustaceans and fish, with tissue concentration decreasing 30-50 percent in 24-28 days. Bioaccumulation factors (concentration of Kepone in predator/concentration in prey) at 30 days were equal (0.85 spot/mysid; 0.53 mysid/brine shrimp) in the high and low concentrations tested. The initial bioconcentration of Kepone from water by plankton was the dominant source of Kepone to each member of this food chain, but significant (less than 85 percent) quantities of Kepone transferred from prey to predatory fish. GRA

N78-24693# Iowa State Dept. of Environmental Quality, Des Moines.
IOWA AIR QUALITY REPORT 1976
Aug. 1977 100 p refs
(PB-277253) Avail: NTIS HC A05/MF A01 CSCL 13B

Iowa's air monitoring data from 1959 to 1976 has been compiled for seven pollutants monitored in the State: suspended particulates, sulfur dioxide, nitrogen dioxide, carbon monoxide, hydrocarbons, photochemical oxidants, and sulfates. The data are presented in tabular form for each of the twelve Air Quality Control Regions in the State. To help the reader better understand the large amount of technical information in this report, additional sections discussing the pollutants and pollutant sources, the air monitoring network, and the analysis of data and trends have been added. Brief summary of another Departmental project, the development of a Pollutant Standards Index, is also included. Author

N78-24694# Energy Research and Development Administration, Washington, D. C.
OIL SHALE, FY 1977
J. D. Powderly and R. Franklin Jun. 1977 56 p
(EDP/F-01(77)) Avail: NTIS HC A04/MF A01

The environmental, health, safety, and socioeconomic issues concerning the development of the program were identified and examined, and the requirements and actions needed to resolve these issues, and a time phased action plan for the evaluation and mitigation of environmental impacts is presented. The plan addressed the oil shale energy system including mining, crushing and sizing, fracturing, in situ and surface retorting, product recovery and upgrading, transportation, and end use. ERA

N78-24695# Oak Ridge National Lab., Tenn.
KINETIC MODEL FOR PREDICTING THE COMPOSITION OF CHLORINATED WATER DISCHARGED FROM POWER PLANT COOLING SYSTEMS
Milton H. Lietzke 1977 13 p refs Presented at the Conf. on Water Chlorination: Environ. Impact and Health Effects, Gatlinburg, Tenn., 31 Oct. 1977
(Contract W-7405-eng-26)
(CONF-771070-1) Avail: NTIS HC A02/MF A01

The results of applying a kinetic model to the chlorination data on the once-through cooling system at the Quad Cities Nuclear Station provide a validation of the model. The two examples given demonstrate that the model may be applied to either once-through cooling systems or to cooling systems involving cooling towers. ERA

N78-24696# Oak Ridge National Lab., Tenn.
ENVIRONMENTAL, HEALTH, AND CONTROL ASPECTS OF COAL CONVERSION, AN INFORMATION OVERVIEW, VOLUME 1
H. M. Braunstein, ed., E. D. Copenhaver, ed., and H. A. Pfuderer, ed. Apr. 1977 538 p refs
(Contract W-7406-eng-26)
(ORNL-EIS-94-Vol-1) Avail: NTIS HC A23/MF A01

Topics include: coal, its origin, classification, and physical and chemical properties; coal conversion processes; process effluents (quantities and control technologies); and the analysis of coal and coal products (including wastes). ERA

N78-24697# Oak Ridge National Lab., Tenn.
ENVIRONMENTAL, HEALTH, AND CONTROL ASPECTS OF COAL CONVERSION: AN INFORMATION OVERVIEW, VOLUME 2
H. M. Braunstein, ed., E. D. Copenhaver, ed., and H. A. Pfuderer, ed. Apr. 1977 797 p refs
(Contract W-7405-eng-26)
(ORNL-EIS-95-Vol-2) Avail: NTIS HC A99/MF A01

The five chapters from this second volume entered individually into EDB, ERA and EAPA deal with the environmental behavior of possible pollutants (polycyclic aromatic hydrocarbons, sulfur dioxide, nitrogen oxides, trace elements, etc.) from coal conversion plants and the possible biological effects of these pollutants on microbes, plants, animals and man (including occupational diseases). The results presented are very detailed, but made reasonably accessible by the incorporation of appendices giving IUPAC names and structural formulae of common polycyclic aromatic hydrocarbons and a chemical index. ERA

N78-24698# United Nations Educational, Scientific and Cultural Organization, Paris (France).
REGIONAL MEETING OF EXPERTS ON ENVIRONMENTAL EDUCATION IN ASIA International Environmental Education Programme - UNESCO-UNEP. Final Report
10 Feb. 1977 73 p refs Conf. held at Bangkok, 15-20 Nov. 1976
(UNESCO-ED-77/WS/22) Avail: NTIS HC A04/MF A01

Following a description of the environmental situation in Asia, the need and basis for environmental education is discussed. Problems and activities in environmental education in Asia are reviewed and features for improving it are presented. ESA

N78-24699# United Nations Educational, Scientific and Cultural Organization, Paris (France).
REGIONAL MEETING OF EXPERTS ON ENVIRONMENTAL EDUCATION IN LATIN AMERICA AND THE CARIBBEAN International Environmental Education Programme - UNESCO-UNEP. Final Report
1 Mar. 1977 57 p Conf. held at Bogota, 24-30 Nov. 1976 Sponsored by Konrad Adenauer Found.
Avail: NTIS HC A04/MF A01

The background and objectives of the meeting are outlined followed by discussions on environmental education in the context of ecodevelopment and life-long education in Latin America. The present state of environmental education and the educational systems in Latin America are reviewed and strategies to introduce and develop environmental education at regional and national levels in Latin America are presented. ESA

N78-24700# Southern Research Inst., Birmingham, Ala.
PARTICULATE CONTROL HIGHLIGHTS: ADVANCED CONCEPTS IN ELECTROSTATIC PRECIPITATORS, PARTICLE CHARGING Final Task Report, Nov. 1976 - Nov. 1977
D. Pontius and W. Smith Dec. 1977 14 p refs
(Contract EPA 68-02-2114)

(PB-277222/6; SORI-EAS-77-676; EPA-600/8-77/020c) Avail: NTIS HC A02/MF A01 CSCL 07D

A theory was developed, in which the thermal motion of ions was assumed to dominate the charging process. The theory was shown to agree to within 15% of published experimental data. Experimental determinations of particle charging were made, using a mobility analyzer to find the end points of particle trajectories in an electric field. GRA

N78-24701# Environmental Protection Agency, Denver, Colo.
AMBIENT AIR QUALITY MONITORING NETWORK EPA REGION VIII ENERGY AREAS
George Boulter and Barry Levene Oct. 1977 157 p
(PB-277673; EPA-908/4-77-011) Avail: NTIS HC A08/MF A01 CSCL 13B

The ambient air quality monitoring network located in Energy development areas in the states in Region VIII (Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming) is described. The data collected from these monitoring locations for several years is summarized. Comparisons between data collected in 1975 and 1976 at selected monitoring sites is presented. Author (GRA)

N78-24702# Oceanographic Inst. of Washington, Seattle.
MODELING METHODS FOR PREDICTING OIL SPILL MOVEMENT
Robert J. Rath and Bradley H. Francis Mar. 1977 106 p refs
(PB-277669; OIW-OCW-7502) Avail: NTIS HC A06/MF A01 CSCL 13B

A literature search and an evaluation of 17 representative papers on modeling the surface movement of spilled oil in the marine environment are presented. The modeling approaches vary considerably in complexity and are based on experiments, observations, and theoretical considerations, or combinations. In addition to the evaluation of the individual models, an overview of the state of the art of predicting oil spill movement by utilizing oil spreading and drift models was also included. Controversial parameters, methods of model verification, and studies which are being conducted to extend the methodology to three dimensions by considering the distribution of spilled oil in the atmosphere, the water column, and bottom sediments were discussed. Author

N78-24703# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Fisheries and Wildlife Sciences.
A COMPUTERIZED METHOD FOR ABSTRACTING AND EVALUATING ENVIRONMENTAL IMPACT STATEMENTS
G. F. Martel and R. T. Lackey Dec. 1977 100 p refs Sponsored by Dept. of Interior
(OWRT Proj. A-070-VA(1))
(PB-277459; W78-03970; Bull-105) Avail: NTIS HC A05/MF A01 CSCL 13B

This study describes the Dam Impact Evaluation System (DES), developed specifically for evaluating and comparing impacts from dam projects and project alternatives. The DES operates on the creation of a distribution based on low, most likely, and high inputs by project evaluators on both impact and importance of factors and actions. Computer output includes comparisons between projects in both tabular and graphic form. Information is available on estimated impact, variance of the estimator's inputs, and probabilities of differences between projects. The DES provides a method by which the value judgments and estimates of evaluators may be dealt with statistically. Both impact and weighting factors are considered, based on the probability distributions of evaluator input. Weighting factors are combined with impact to form weighted values that may be used in comparing dam projects and alternatives. GRA

N78-24704# California Inst. of Tech., Pasadena.
INTERNATIONAL CONFERENCE ON OXIDANTS, 1976: ANALYSIS OF EVIDENCE AND VIEWPOINTS. PART 6: THE ISSUE OF AIR QUALITY SIMULATION MODEL UTILITY
Final Report
John H. Seinfeld and Kent R. Wilson Nov. 1977 121 p refs Prepared in cooperation with California Univ., San Diego, La Jolla
(Contracts DA-7-2143A; DA-7-2191J)
(PB-277463; EPA-600/3-77-118-Pt-6) Avail: NTIS HC A06/MF A01 CSCL 13B

In recognition of the important and somewhat controversial nature of the oxidant control problem, the U.S. Environmental Protection Agency (EPA) organized and conducted a 5-day International Conference in September 1976. The more than one hundred presentations and discussions at the Conference revealed the existence of several issues and prompted the EPA to sponsor a followup review/analysis effort. The followup effort was designed to review carefully and impartially, to analyze relevant evidence and viewpoints reported at the International Conference (and elsewhere), and to attempt to resolve some of the oxidant-related scientific issues. The review/analysis was conducted by experts (who did not work for the EPA or for industry) of widely recognized competence and experience in the area of photochemical pollution occurrence and control. The issue of air quality simulation model (AQSM) utility, the strengths and weaknesses of the various modeling techniques are discussed. Recommendations on future studies are proposed. Author

N78-24705# Connecticut Univ., Storrs. Inst. of Water Resources.
SPREADING OF OIL SLICKS IN A WIND-WAVE CHANNEL
J. D. Lin and G. S. Campbell Sep. 1977 14 p refs Sponsored by Office of Water Research and Technology.
(OWRT Proj. A-059-CONN(2))
(PB-277486; W78-03962) Avail: NTIS HC A02/MF A01 CSCL 13B

Drift velocities of surface films floating on the water surface under the action of wind-generated waves and mechanically generated waves were investigated in a laboratory wind-wave channel by using polyethelene sheets. In order to simulate the drift of oil slicks in a laboratory channel, the size of the film should be greater than two wavelengths for wind-waves and one wavelength for mechanically generated waves. Film drift velocity over wind-generated waves is a function of wind velocity and wave steepness. However, the ratio of drift velocity to shear velocity of the air boundary layer correlates uniquely with wave steepness and becomes independent of wave steepness for sufficiently large wave steepness. Experiments of oil films under the action of wind-generated waves were also carried out in the wind-wave channel. Drift velocities of oil slicks are initially influenced by the size of oil volume due to the asymmetrical spreading in the direction of winds; however, they approach the values of film drift velocities as the fetch increases downwind. GRA

N78-24706# Connecticut Univ., Storrs. Inst. of Water Resources.
COMPUTER TECHNIQUES FOR IDENTIFYING OIL SPILLS
Y. T. Chien Oct. 1977 21 p refs
(OWRT Proj. A-060-CONN(1))
(PB-277487; W78-03963) Avail: NTIS HC A02/MF A01 CSCL 13B

The use of pattern recognition methods as applied to oil spill identification problems was investigated. Two computer-based systems that are potentially useful for assisting the human user in the identification process were developed. The first is an interactive system which is suitable for manipulating discrete waveforms (such as infrared or fluorescent spectra) with the aid of a graphical display. The other system is a general two-dimensional pictorial information processor, potentially useful for identifying oil images such as those produced by thin-layer chromatography. A probability model for matching suspects with spills was also developed. This model utilizes information contained in chemical spectra obtained from suspects and spill samples. It also considers the possibility that the true spiller escaped without being sampled. Author (GRA)

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N78-24707# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
APPLICATION OF FOURTH-ORDER ACCURATE DIFFERENCES TO A THREE-PARAMETER BAROCLINIC MODEL OF THE ATMOSPHERE, PART 2
I. M. Navon and Z. Alperson Jun. 1977 30 p refs
(CSIR-SR-WISK-260-Pt-2; ISBN-0-7988-1132-3-Pt-2) Avail: NTIS HC A03/MF A01

Fourth-order difference approximations are implemented in a three-parameter baroclinic quasigeostrophic model of the atmosphere based on a modified version of the Bushby-Whitelam model, currently in use at the Israeli Meteorological Office. The fourth-order accurate numerical forecast on a mesh covering Europe and the Mediterranean regions results in improved locations of low- and high-pressure centres as compared with the second-order forecast. The scheme also yields better estimates of the changes in position and intensity of the synoptic systems. The fourth-order numerical forecast tends, however, to lower the values at the pressure centres. Author

N78-24708*# Dartmouth Coll., Hanover, N.H.
VULCANIAN ERUPTION MECHANISMS
Stephen Self (Lancaster Univ., England), Lionel Wilson, and Ian A. Nairn (New Zealand Geological Survey, Rotorua) 1978 17 p refs
(Grants NsG-5145; NSF EAR-76-22319)
(NASA-CR-157063) Avail: NTIS HC A03/MF A01 CSCL 08K

Volcanological observations of explosive eruptions show that previous estimates of pre-explosion gas pressures may be overestimated by an order of magnitude. Author

N78-24709*# California Inst. of Tech., Pasadena. Seismological Lab.
PRESENT-DAY PLATE MOTIONS
J. Bernard Minster and Thomas H. Jordan (Scripps Institution of Oceanog., La Jolla, Calif.) 10 Nov. 1977 83 p refs Submitted for publication
(Grant NsG-5089)
(NASA-CR-156761) Avail: NTIS HC A05/MF A01 CSCL 08F

A data set comprising 110 spreading rates, 78 transform fault azimuths and 142 earthquake slip vectors was inverted to yield a new instantaneous plate motion model, designated RM2. The mean averaging interval for the relative motion data was reduced to less than 3 My. A detailed comparison of RM2 with angular velocity vectors which best fit the data along individual plate boundaries indicates that RM2 performs close to optimally in most regions, with several notable exceptions. On the other hand, a previous estimate (RM1) failed to satisfy an extensive set of new data collected in the South Atlantic Ocean. It is shown that RM1 incorrectly predicts the plate kinematics in the South Atlantic because the presently available data are inconsistent with the plate geometry assumed in deriving RM1. It is demonstrated that this inconsistency can be remedied by postulating the existence of internal deformation with the Indian plate, although alternate explanations are possible. Author

N78-24710*# National Aeronautics and Space Administration, Washington, D. C.
TRANSMISSION FUNCTIONS FOR VARIOUS MODELS OF THE ATMOSPHERE FOR CHANNELS OF SOVIET AND AMERICAN RADIOMETERS (15 MICRON CO2 BAND)
May 1978 27 p Transl. into ENGLISH of "Funktsii Propuskaniya dlya Razlichnykh Modeley Atmosfery dlya Kanaolov Sovetskogo i Amerikanskogo Radiometrov (15 mkm Poloso CO2)", Rept. Acad. of Sci. USSR and Joint Sov.-Am. Working Group on Space Meteorol., Moscow, Apr. 1978 26 p Transl. by Transemantics, Inc., Washington, D. C. Original doc. prepared by Acad. of Sci. USSR
(Contract NASw-2792)
(NASA-TM-75105) Avail: NTIS HC A03/MF A01 CSCL 04A

Listed are various graphs and tables for illustrations related to Point IX of a list of works conducted by the USSR in accordance with the Joint Soviet-American Research Program on improving methods of thermal sounding from satellites. Author

N78-24711*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE REACTION Cl + H2CO YIELDS HCl + HCO: DECREASED SENSITIVITY OF STRATOSPHERIC OZONE TO CHLORINE PERTURBATIONS
L. J. Stief, J. V. Michael, W. A. Payne, D. F. Nava, D. M. Butler, and R. S. Stolarski May 1978 15 p refs Submitted for publication
(NASA-TM-79552) Avail: NTIS HC A02/MF A01 CSCL 04A

The absolute rate constant for the reaction Cl + H2CO yields HCl + HCO was determined by the flash-photolysis resonance fluorescence method to be 7.5 plus or minus 0.9 (2 sigma) times 10 to the minus 11th power cu cm/molecule sec at 298 K and to have a negligible temperature dependence. This rate which is more than 2000 times faster than the rate of Cl + CH4 indicates that formaldehyde (H2CO) will compete significantly with methane (CH4) for the conversion of active chlorine in the stratosphere to the inactive reservoir HCl. Chlorine will thus be a less efficient destroyer of stratosphere ozone than previously believed. Ambient statrospheric ozone will depend less on the ambient chlorine amount and the predicted response to chlorine perturbations will be lessened. One-dimensional eddy-diffusion photochemical model calculations indicate a factor of 1.1 less sensitivity to chlorine than recently reported. For a steady-state CFM release at 1975 rates (750,000 tons/year) the eventual ozone depletion is now calculated to be 14%. Author

N78-24712# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
THE ACCURACY OF FREE NETWORKS IN GEODETIC PROJECTION AND THEIR APPLICATION IN SURVEYING LONG TUNNELS Ph.D. Thesis [DIE GENAUIGKEIT FREIER NETZE IN KARTESISCHER DARSTELLUNG UND IHRE ANWENDUNG ZUR ABSTECKUNG LANGER STOLLEN]
D. E. Peter Gerber 1977 155 p refs In GERMAN
(Diss-5722) Avail: NTIS HC A08/MF A01

By expanding the geodetic projection to the third dimension, the basis is given for a simple calculation of geodetic networks in situation and altitude. These altitudes are definite in a real metric system and are not influenced by the field of the earth gravitation. On the other hand, the basis for network calculations, the determination of weights and the accuracy of geometric measurements are discussed by using high precision measurements in a mountain area. An example calculation for the free network Strassentunnel Gotthard is outlined. Author

N78-24713# Council for Scientific and Industrial Research, Pretoria (South Africa). Foreign Language Service.
USE OF A NEUTRON DEPTH PROBE WITH A SHIELD TO MEASURE SURFACE SOIL MOISTURE CONTENT
P. Moutonnet 1977 10 p refs Transl. into ENGLISH from Ann. I.T.B.T.P. (France), no. 233, 1967 p 1-5
(CSIR-Trans-1375) Avail: NTIS HC A02/MF A01

Fast neutrons emitted by the active source of the depth probe penetrated a certain volume of soil. Measurement of the density of thermal neutrons close to the emitter, in terms of a calibration curve, determined the mean moisture content at a given point. In an infinite medium, detection occurred in a 4 pi volume in conditions of constant geometry. The addition of a neutron shield permits possibilities of measurement near the soil surface. Author

N78-24714# Air Force Geophysics Lab., Hanscom AFB, Mass.
THERMAL AND HYPERTHERMAL ELECTRON DISTRIBUTIONS IN THE MIDNIGHT SECTOR OF THE WINTER TOPSIDE IONOSPHERE
W. J. Burke, R. C. Sagalyn, and M. Kanal 28 Nov. 1977 28 p refs
(AF Proj. 2311)
(AD-A051419; AFGL-TR-77-0262; AFGL-ERP-615) Avail: NTIS HC A03/MF A01 CSCL 04/1

A gridded spherical electrostatic analyzer aboard Injun 5 has been used to measure fluxes of thermal and hyperthermal electrons at sub-auroral latitude in the midnight sector of the northern ionosphere between altitudes of 2500 and 850 km. Due to the offset between the geomagnetic and geographic poles, hyperthermal fluxes consisting of energetic photoelectrons that have

escaped from the sunlit southern hemisphere are observed along orbits over the Atlantic Ocean and North America but not over Asia. The ambient electron temperatures near 2500 km have their highest values at trough latitudes for all longitudes. Based on these observations it is concluded that: At trough latitudes, elevated electron temperatures in the topside ionosphere are produced by sources other than conjugate photoelectrons. Equatorward of the trough in the Atlantic Ocean, North American longitude sector conjugate photoelectrons contribute significantly to the heating of electrons in the topside ionosphere. Much of the photoelectron energy is deposited at altitudes greater than 2500 km, then conducted along magnetic field lines into the ionosphere. GRA

N78-24715# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

THE RESPONSE OF ATMOSPHERIC AND LOWER IONOSPHERIC LAYER STRUCTURES TO GRAVITY WAVES Interim Report

Yam T. Chiu and Barbara K. Ching 6 Feb. 1978 26 p refs (Contract F04701-77-C-0078)

(AD-A051718; TR-0078(3960-04)-2; SAMSO-TR-78-39) Avail: NTIS HC A03/MF A01 CSCL 04/1

Solution was made of the linear and quasi-linear problems of the density response of a neutral or ionospheric layer structure of arbitrary density profile to gravity wave perturbations in the background atmosphere. It is shown that the density response of the bottomside of the structure is of larger amplitude than the topside, whereas the general magnitude of the density response depends on the relative sharpness of the layer density gradient in comparison to the gradient of background atmosphere stratification. The sharper the layer gradient, the larger the layer density response. Interpretation and application of the results to the ozone and atomic oxygen layers, the sporadic-E layer and to the D and E regions of the ionosphere are discussed. GRA

N78-24716# Air Force Academy, Colo. Dept. of Economics, Geography and Management.

AVALANCHE AND NON-AVALANCHE TALUS SLOPE COMPARISON, COLORADO FRONT RANGE Final Report

Thomas P. Huber Oct. 1977 41 p refs

(AD-A051331; USAFA-TR-77-14) Avail: NTIS HC A03/MF A01 CSCL 08/7

Comparison of three talus slopes in the Front Range of the Rocky Mountains in Colorado shows differences in their formative processes. Avalanche, rockfall, alluvial, and mudflow processes appear in differing proportions on the slopes. Development of slope profiles helps differentiate between slope-forming factors. Regression equations show relationships between downslope distance and boulder size and between downslope distance and slope angle. Analysis of soil samples determines percentages of sand, silt, and clay. Finally, qualitative factors prove invaluable in confirming the presence of specific slope-forming processes. Author (GRA)

N78-24717# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.

MONTHLY 90-DEG N ATMOSPHERES AND HIGH-LATITUDE WARM AND COLD WINTER STRATOSPHERE/MESOSPHERE

Arthur J. Kantor and Allen E. Cole 14 Dec. 1977 30 p refs (AF Proj. 6670)

(AD-A051421; AFGL-TR-77-0289; AFGL-ERP-620) Avail: NTIS HC A03/MF A01 CSCL 04/1

A set of 12 mean monthly reference atmospheres, which describes the seasonal changes in the distribution of the thermodynamic properties of the atmosphere, is provided for the North Pole for altitudes up to 55 km. Additional atmospheric models for arctic and subarctic regions are presented to describe the large variations that occur in the vertical distributions of atmospheric temperature, density, and pressure during typical warmings and coolings of the winter stratosphere and mesosphere. GRA

N78-24718# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.

SYNTHETIC SEISMOGRAMS USING THE STATE SPACE APPROACH Interim Report

J. M. Mendel, N. E. Nahi, and M. Chan 1977 41 p refs Sponsored in part by Chevron Oil Field Res. Co. and Teledyne Exploration Co.

(Grants AF-AFOSR-2797-75; NSF ENG-74-02297-A01; NSF ENG-75-03423)

(AD-A051059; AFOSR-78-0200TR) Avail: NTIS HC A03/MF A01 CSCL 08/11

In this paper time-domain state space models for lossless layered media are developed which are described by the wave equation and boundary conditions. Our models are for non-equal one-way travel time; hence, they are more general than existing models of layered media which are usually for layers of equal one-way travel times. State space models for two cases are (1) source and sensor at the surface and (2) source and sensor in the first layer. GRA

N78-24719# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.

THERMAL STRUCTURE OF THE TOPSIDE IONOSPHERE OBSERVED BY INJUN 5 DURING AN INTENSE MAGNETIC STORM

W. J. Burke and R. C. Sagalyn 28 Nov. 1977 29 p refs (AF Proj. 2311)

(AD-A051418; AFGL-TR-77-0261; AFGL-ERP-614) Avail: NTIS HC A03/MF A01 CSCL 04/1

Electron densities and temperatures as well as omnidirectional fluxes of hyperthermal positive ions (E = 28 eV) were measured by means of spherical Langmuir probes aboard INJUN 5 at altitudes = 2000 km during a major geomagnetic storm. The electron density in the mid-latitude trough decreased and the temperatures increased during the early phases of the storm. As the storm progressed the trough's position moves equatorward with plasma depletions being observed to an invariant latitude of 40 deg during the early recovery phase. The latitude of the transition between heavy and light ion dominance also moved equatorward, but recovered at a rate slower than that of the electron trough's position. Hyperthermal ions detected in the vicinity of the trough were ring current particles reaching to the satellite's altitude. The minimum thermal electron densities in the trough were found to be within 1 deg of latitude of the maximum ring current flux. Maximum electron temperatures were measured several degrees equatorward of this position. INJUN 5 electron temperatures are compared with those measured by Alouette 2 over the reported positions of SAR arcs. The observations are also used to further evaluate a method developed for calculating the position of the ring current using ground magnetic fluctuations. GRA

N78-24720# Illinois Univ. at Urbana-Champaign, Urbana. Ionosphere Radio Lab.

A MULTI-CHANNEL DIGITAL DATA LOGGING SYSTEM FOR IONOSPHERIC SCINTILLATION STUDIES

K. S. Yang and A. L. Hearn Jul. 1977 85 p refs (Contract DAAG29-76-G-0286)

(AD-A051754; UILU-ENG-77-2259; ARO-14260.3-ELX; TR-61) Avail: NTIS HC A05/MF A01 CSCL 14/3

This report describes a multi-channel digital data logging system designed specifically to digitize and record the analog transmissions from radio beacon satellites which are subsequently used for ionospheric scintillation studies. System specifications and design diagrams are given. This system has been actually built and is currently recording data. The computer software necessary to produce a digital magnetic tape for further data processing is described in the Appendix. Author (GRA)

N78-24721# Stanford Univ., Calif. Radioscience Lab.

CONTROLLED ARTIFICIAL GENERATION OF ULTRA-LOW-FREQUENCY HYDROMAGNETIC WAVES IN THE IONOSPHERE AND MAGNETOSPHERE Final Report, Jan. 1975 - Feb. 1977

O. G. Villard, Jr., R. A. Helliwell, A. C. Fraser-Smith, T. F. Bell, D. M. Bubenik, T. L. Crystal, and B. Dingle Feb. 1978 20 p refs

(Contract N00014-75-C-1095; ARPA Order 1733)

(AD-A052353; SU-SEL-77-029; FR-4207-9) Avail: NTIS HC A02/MF A01 CSCL 20/14

This report summarizes theoretical and experimental work sponsored by the Defense Advanced Projects Agency at Stanford

University through the Office of Naval Research Contract No. N00014-75-C-1095. The primary purpose of this work, which was conducted during the interval 1 January 1975 through 28 February 1977, was to investigate the possibility of obtaining a relatively inexpensive method for the controlled artificial generation of ultra-low-frequency (ULF; frequencies less than 5 Hz) geomagnetic pulsations. Because of the great penetration of these signals in sea water, the controlled artificial source could conceivably be used as a transmitter to communicate with deeply submerged receivers at a low data rate. A second purpose of the work was to investigate the feasibility of using airborne loop antennas for air/undersea communication at ULF. The following are the major conclusions of this work; (1) The controlled artificial generation of ULF geomagnetic pulsations by the 'peninsula method,' i.e., by the passage of a ULF-modulated electric current around a relatively nonconducting peninsula in the sea or in a large saline lake, is feasible and that further experiments, in particular, a fullscale ULF wave generation experiment, appear desirable. (2) The controlled artificial generation of ULF geomagnetic pulsations by the 'VLF method,' i.e., by the injection of ULF-modulated VLF signals into the magnetosphere from a large ground-based VLF transmitter, appears possible, but further theoretical and experimental studies are required to clarify the generation mechanism. GRA

N78-24722# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
THE ALTITUDE DEPENDENCE OF THE LOCAL TIME VARIATION OF THERMOSPHERIC DENSITY Interim Report
Lawrence R. Sharp, David R. Hickman, Carl J. Rice, and Joe M. Straus 10 Mar. 1978 20 p refs
(Contract F04701-77-C-0078)
(AD-A052334; SAMSO-TR-78-67; TR-0078(3960-04)-3) Avail: NTIS HC A02/MF A01 CSCL 04/1

Analysis of density measurements from the AE-E satellite have demonstrated that the local time variation in the thermosphere at low latitudes (-20) changes from predominantly diurnal at high altitudes (about 300 km) to predominantly semidiurnal at low altitudes (about 140 km). This behavior is significant because it both affects the accuracy of density predictions at low satellite altitudes and confirms that the mesospheric semidiurnal tide is important to the dynamics of the lower thermosphere. Comparison of the results with the local time dependence found in the thermospheric model of Jacchia (1971) and the MSIS model of Hedin et al. (1977 a and b) indicate that only the latter correctly models the transition to dominantly semidiurnal behavior at lower thermospheric altitudes near the equator. Author (GRA)

N78-24723# Air Force Geophysics Lab., Hanscom AFB, Mass.
LARGE AMPLITUDE IRREGULARITIES AT LOW LATITUDES IN THE TOPSIDE IONOSPHERE Interim Report
W. J. Burke, D. E. Donatelli, R. C. Sagalyn, and M. C. Kelly 28 Nov. 1977 22 p refs
(Contracts F19628-75-C-0081; F19628-77-C-0122; AF Proj. 2311)
(AD-A052268; AFGL-TR-77-0263; AFGL-ERP-616) Avail: NTIS HC A02/MF A01 CSCL 04/1

Observations from the high resolution spherical electrostatic analyzer experiment aboard ISIS 1 have been used to study large amplitude irregularities at low latitudes in the topside ionosphere. The irregularities appeared as plasma depletions near the magnetic equator and were observed up to satellite apogee (3500 km). The altitude-local time distribution of the depletions was such that those at altitudes greater than 2000 km were found only in the post-midnight sector. This result agrees with the predictions of a simple MHD model for plasma bubbles drifting under the influence of gravity-buoyancy forces.
Author (GRA)

N78-24724# ENSCO, Inc., Springfield, Va.
IMPROVED PROCEDURES FOR DETERMINING SEISMIC SOURCE DEPTHS FROM DEPTH PHASE INFORMATION Quarterly Report, 1 Oct. - 31 Dec. 1977
Edward Page and Richard Houck Jan. 1978 18 p
(Contract F08606-77-C-0007; ARPA Order 2251)
(AD-A052333) Avail: NTIS HC A02/MF A01 CSCL 17/10

Implementation of the seismic source depth analysis package at SDAC has been completed. This version includes Calcomp plot output of seismograms, cepstrums, and depth plots, and allows the analyst to easily reprocess an event using different combinations of input data and analysis parameters. Three new processing features have been developed: phase editing, an improved significance level algorithm, and computation of a depth threshold based on data bandwidth. Phase editing permits point-by-point editing of cepstrums, based on phase; the other two features are designed to assist the analyst in interpreting the final depth plots. Author (GRA)

N78-24725# ENSCO, Inc., Springfield, Va.
IMPROVED PROCEDURES FOR DETERMINING SEISMIC SOURCE DEPTHS FROM DEPTH PHASE INFORMATION Final Report, 1 Oct. 1976 - 30 Sep. 1977
Richard Houck and Edward Page 31 Oct. 1977 75 p
(Contract F08606-77-C-0007; ARPA Order 2551)
(AD-A052518) Avail: NTIS HC A04/MF A01 CSCL 17/10

The objective of this research has been to develop an improved technique for estimating the depths of seismic sources at teleseismic distances. Based on this depth estimate, deep events could immediately be classified as earthquakes and further discriminant analysis could be concentrated on the remaining shallow events. Work during this contract has been directed towards further improving and evaluating the automated depth determination procedure developed during three previous contracts. This procedure uses computed travel times to combine depth phase information associated with P, PP, PPP, and PcP arrivals recorded at a network of stations. The resulting depth estimate is better than those obtained by conventional methods, which do not make full use of all this depth phase information.
GRA

N78-24726# Texas Instruments, Inc., Dallas. Equipment Group.
EXTRACTION OF LONG-PERIOD SURFACE WAVES
Stephen S. Lane 8 Dec. 1977 30 p refs
(Contract F08606-77-C-0004; ARPA Order 2551)
(AD-A052828; TI-ALEX(01)-TR-77-08) Avail: NTIS HC A03/MF A01 CSCL 17/10

Gains from a cascaded Wiener filter, three component adaptive (TCA) filter, and prewhitened matched filter were measured for various orders of application to long-period surface waves buried in seismic noise. It was found that the gain of the cascaded Wiener filter and three component adaptive filter was greater than the sum of their individual gains, and that this was the best order of application, but that following them with the matched filter reduced the overall gain over the range of input signal to noise ratio of interest. These results are due to the non-linear nature of the TCA and to the distortion inherent in its output.
GRA

N78-24727# California Univ., San Diego. Dept. of Applied Physics and Information Science.
THE MEASUREMENT OF ELECTRICAL CONDUCTIVITY IN THE STRATOSPHERE Final Report, 1 Jun. 1975 - 30 Nov. 1977
P. Roger Williamson 19 Feb. 1978 8 p refs
(Grant DAHC04-75-G-0155)
(AD-A052821; ARO-12911.1-GS) Avail: NTIS HC A02/MF A01 CSCL 04/1

Measurements of the galactic cosmic ray ionization rate in the stratosphere have been used to develop a global model. Above 25 km an analytic form for the height dependence of ionization was found. In the second part of this work, ion conductivity was measured near the sampling aperture of a balloon-borne ion mass spectrometer. Data from two flights demonstrated that ionization was present near the aperture at all times during both flights but that a large variation could sometimes occur in the probe current. On the second flight a turbulence layer was observed near 80,000 ft. altitude.
Author (GRA)

N78-24728# Texas Univ., El Paso. Dept. of Electrical Engineering.
AN EFFICIENT COMPUTATIONAL APPROXIMATION TO THE LORENTZ LINE MOLECULAR ABSORPTION COEFFICIENT M.S. Thesis

Michael T. Potter May 1977 147 p refs
(AD-A052686) Avail: NTIS HC A07/MF A01 CSCL 04/1

A rapid and accurate approximation to the Lorentz line molecular absorption coefficient has been developed which significantly reduces the time of line-by-line transmittance calculations. By separating computations required for each spectral line, atmospheric level, and absorbing gas under consideration, arithmetical operations are minimized. Time tests were conducted while computing the monochromatic absorption coefficient for five frequency channels in the 4.3 micrometers band. The approximation was compared to the evaluation of the Lorentz line shape (Standard manner) for a 33 level atmosphere and an average of 1000 absorption lines per region. Absorption coefficient values computed by this approximation agreed to those computed in the standard fashion to at least three decimal places regardless of molecule type, channel, or atmospheric level. Average percent-relative errors were typically: .0001 for H2O; .0001 for CO2: .001 for N2O; .00000001 for CO. For transmittance calculations over a band, time savings can be predicted by analyzing the required number of arithmetical operations. For 1,000 spectral lines over a bandwidth of 25/cm and a step increment of 0.02/cm, a reduction in computation time of 450% is anticipated. GRA

N78-24729# Texas Univ., El Paso. Dept. of Electrical Engineering.
A COMPUTATIONAL METHOD FOR SPECTRAL MOLECULAR ABSORPTION USING AN IMPROVED VOIGT ALGORITHM M.S. Thesis
Peter Clark VanDerwood May 1977 179 p refs
(AD-A052685) Avail: NTIS HC A09/MF A01 CSCL 04/1

Discussion of the fundamental elements and theory related to atmospheric transmittance is presented. A line-by-line transmission computer program is developed that utilizes the combined Doppler-Lorentz (Voigt) line broadening function. In addition a rapid algorithm to evaluate the Voigt function with a maximum relative error of about one part in 10,000 is described and a software package that processes the absorption line parameters necessary to calculate transmittance is given. The results of transmittance calculations for seven channels in the fifteen micrometer band, corresponding to the seven High Resolution Infrared Radiation Sounder (HIRS) channels, are furnished and the procedure to compute a band averaged transmission discussed. It is concluded that the Voigt algorithm developed here is an excellent computational procedure and the resulting transmittance program correctly calculates atmospheric transmission. Author (GRA)

N78-24730# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Chemical Systems Lab.
INTRODUCTION TO POLYMOLECULAR WATER CLUSTERS AND THEIR INFRARED ACTIVITY Technical Report, Jan. - Dec. 1977
Hugh R. Carlson Feb. 1978 33 p
(AD-A052699; AD-E400102; ARCSL-TR-78014) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report is intended as a guide for electro-optical applications engineers interested in the effects of polymolecular clusters of water upon infrared transmission of the atmosphere. It is a compendium of work on the subject ranging from the oldest to the newest, some of which is not yet generally accepted by the scientific community. A theoretical model for infrared absorption spectra due to intermolecular hydrogen bonding is developed from a simple cluster model. Expressions leading to approximate values of hydrogen-bond strength are developed, allowing equations and curves to be derived, from data in the literature, for equilibrium cluster concentrations in moist air or water vapor, as functions of saturation ratio and temperature. The very large differences in absorptivity between water in the vapor and liquid phases are explained, as are 'pressure-squared' and inverse temperature dependencies of water cluster absorption in the infrared. Applications are suggested. Author (GRA)

N78-24731# Sandia Labs., Albuquerque, N. Mex.
MECHANICAL PROPERTIES OF OIL SHALE OF IMPORTANCE TO IN-SITU RUBBLIZATION
K. W. Schuler and R. A. Schmidt 1977 16 p Presented at Amer. Nucl. Soc. Topical Meeting on Energy and Mineral Recovery Research, Golden, Colo., 12 Apr. 1977
(Contract EY-76-C-04-0789)
(SAND-77-0499C; Conf-770440) Avail: NTIS HC A02/MF A01

Current proposals for true in-situ processing of oil shale employ deeply buried explosive charges to produce the desired rubblization. At short times after the explosion, the dynamic behavior of the material is of interest and can be studied in shockwave experiments. At intermediate times the divergence of the flow field requires a multidimensional specification of the material behavior which appears to be best determined from triaxial test data. At late times the possible formation of tensile stresses requires knowledge of the fracture mechanics and tensile behavior of the shale. This report presents a summary of techniques and results of triaxial compression, extension and fracture toughness tests on two grades of oil shale. Results indicate that oil shale differs significantly from most rocks and suggest that models originally developed for composite materials may be appropriate for describing the mechanical behavior of oil shale. ERA

N78-24732# Sandia Labs., Albuquerque, N. Mex.
MASSIVE HYDRAULIC FRACTURE MAPPING AND CHARACTERIZATION PROGRAM. SURFACE POTENTIAL DATA FOR WATTENBERG 1975 - 1976 EXPERIMENTS
R. P. McCann, L. C. Bartel, and L. J. Keck Aug. 1977 55 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0396) Avail: NTIS HC A04/MF A01

Three massive hydraulic fracture experiments for natural gas stimulation were conducted on three wells. All three wells were open hole and the fracture zone was located at a depth of approximately 8000 ft. All were treated with approximately 300,000 gal of fluid and 600,000 lb of proppant. The surface electrical potential technique was used to attempt characterization and mapping of the fracture. The noise perturbating the system consists of telluric currents, currents from industrial sources, and natural local currents. It is difficult to determine the exact signal-to-noise ratio or the exact origin of the noise without exhaustive field measurements and data analysis. To aid in the interpretation of the field data, mathematical modeling efforts were undertaken. Data analysis indicates that the fracture orientation for all three wells lies in a SE to NW direction and that the fractures are asymmetric. ERA

N78-24733# Sandia Labs., Albuquerque, N. Mex.
SHALLOW FORMATION HYDROFRACTURE MAPPING EXPERIMENT
L. J. Keck and C. L. Schuster 1977 30 p refs Presented at ASME Energy Technol. Conf. on Composites in Pressure Vessels and Piping, Houston, Tex., 18 Sep. 1977
(Contract EY-76-C-04-0789)
(SAND-77-0142C; Conf-770903-6) Avail: NTIS HC A03/MF A01

Geophysical diagnostic techniques developed to characterize massive hydraulic fractures are described along with a system based on the measurement of surface electrical potentials. Model calculations indicate that the electrical potentials produced by direct electrical excitation of the fracture well and the fracture fluid can be used to determine the direction and asymmetry of a massive fracture. A small scale, shallow formation hydrofracture experiment conducted in an attempt to better correlate theoretical and experimental data is discussed. ERA

N78-24734# Rhode Island Univ., Kingston. Graduate School of Oceanography.
PALEOMAGNETIC STRATIGRAPHY OF NORTH PACIFIC GIANT PISTON CORE LL44-GPC3 (30 DEG. 20 MIN. N, 157 DEG. 50 MIN. W, MPG-I STUDY AREA)
R. A. Prince and G. R. Heath Jul. 1977 29 p refs
(Contract EY-76-S-02-2689)
(COO-2689-8) Avail: NTIS HC A03/MF A01

Stable detrital remanent magnetization in North Pacific core GPC-3 (30 degrees 19.9 minutes N, 157 degrees 49.9 minutes W) allows the upper 4.5 m to be dated by correlation with the standard geomagnetic time scale. The sedimentation rate for

this interval decreases from 2.5 mm/1000 yr. at the surface to 1.1 mm/1000 yr. at 2 m.y. Older sediments lack the consistently stable DRM required for similar dating, but stable DRM paleoinclination measurements at 2250 cm suggest deposition at a paleolatitude between 7.6 and 13.1 degrees N. Based on current reconstructions of the absolute drift of the crust of the Pacific, this implies an age of deposition of 61 to 71 m.y. Such a range is consistent with P. Doyle's biostratigraphic estimates based on ichthyolith assemblages. Sedimentation at GPC-3 appears to have been continuous for the past 70 million years, with the rate increasing from less than 0.3 m/my at the base to 2.5 m/my at the sea floor. ERA

N78-24735# Bayerische Akademie der Wissenschaften, Munich (West Germany). Bayerische Kommission fuer die Internationale Erdmessung.

ACTIVITIES OF THE SPECIAL RESEARCH GROUP 78 ON SATELLITE GEODESY AT MUNICH TECHNICAL UNIVERSITY Annual Report, 1976 [DIE ARBEITEN DES SONDERFORSCHUNGSBEREICHES 78 SATELLITENGEODAESIE DER TECHNISCHEN UNIVERSITAET MUENCHEN IM JAHRE 1976]

Manfred Schneider and Rudolf Sigl 1977 281 p refs In GERMAN

(Astron-Geodaet-Arb-36; ISBN-3-7696-9779-0) Avail: NTIS HC A13/MF A01

The topics covered are directional measurements, noting the use of the Danjon Astrolabe in longitude and latitude measurement at the Wettzell ground station; laser and Doppler satellite ranging; models and methods for utilization of data in satellite geodesy; and figure and field parameter determination. ESA

N78-24736# Istituto di Fisica Dell Atmosfera, Rome (Italy).

LIDAR IN THE STUDY OF THE ATMOSPHERE [IL LIDAR NELLO STUDIO DELL'ATMOSFERA]

A. Guerrini and S. Mazzucco Jan. 1976 107 p refs In ITALIAN; ENGLISH summary

(IFA-SP-10) Avail: NTIS HC A06/MF A01

The fundamental principles of lidar, its experimental characteristics, relative analytical equations, and the experience achieved showing the application possibilities of lidar are examined in detail. Topics dealt with include optical interactions in the atmosphere (Rayleigh diffusion, molecular diffusion, diffusion of big particles, Mie theory, Raman diffusion); Raman retrodiffusion and resonant retrodiffusion; and noise considerations. ESA

N78-24737# Istituto di Fisica Dell Atmosfera, Rome (Italy).

SOLAR RADIATION IN ITALY. COLLECTION OF DATA RECORDED BY NATIONAL SERVICES AND VARIOUS ORGANIZATIONS FROM 1913 TO 1972 [L'INSOLAZIONE SULL'ITALIA. RACCOLTA DEI DATA REGISTRATI DA SERVIZI NAZIONALI ED ENTI VARI (DAL 1913 AL 1972)]

A. Guerrini, A. Lavagnini, and F. M. Vivona Mar. 1977 87 p refs In ITALIAN

(IFA-SP-11) Avail: NTIS HC A05/MF A01

Solar radiation data recorded at 128 stations in Italy were assembled and elaborated. Results are given in numerous tables and maps. Among the many data presented are: a map of daily average insolation per station, idem per region, idem per region per season; and daily average insolation per zone (north, middle, south Italy, Sicily, Sardinia), idem per season. ESA

N78-24738# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).

HIGH ACCURACY GEODETIC-ASTRONOMICAL FIELD OBSERVATION. INVESTIGATIONS OF THE ZINGER AND PEWZOW METHOD Ph.D. Thesis - Tech. Hochschule Karlsruhe, West. Ger. [GEODAETISCH-ASTRONOMISCHE FELDBEOBACHTUNG HOHER GENAUIGKEIT UNTERSUCHUNGEN AN DEN VERFAHREN VON ZINGER UND PEWZOW]

Wolfgang Zick Bayerische Akad. der Wiss. 1977 100 p refs In GERMAN

(Ser-C/Diss-230; ISBN-3-7696-9286-1) Avail: NTIS HC A05/MF A01

Based on observations using a universal instrument Kern DKM3-A after the Zinger- and Pewzow method for star pair longitude and latitude measurement, it is shown that the Horrebow level bubbles in their present exposed version are less suitable for precision measurements in the free field without additional wind and temperature protection. The accuracy of inclination measurements was considerably increased by provision of a wind screen around the instrument and styrofoam casing of the level bubble. ESA

N78-24739# Colorado School of Mines, Golden.

SEISMIC REFLECTIONS FROM GAS RESERVOIRS Final Report

J. E. White Oct. 1977 130 p refs

(Grant NSF AER-75-17526)

(PB-277342; NSF/RA-770321) Avail: NTIS HC A07/MF A01 CSCL 08K

A review of the literature on waves in composite media confirmed that the Biot theory is most applicable to fluid-saturated rocks likely to contain oil or gas. Using the Biot theory, calculations show that fluid motion can grossly affect seismic reflections at a gas-liquid boundary in highly permeable rocks, though for reservoir rocks of more common permeability the effect would occur at higher frequencies (a few kilohertz). Application of the Biot theory to cylindrical rods was compared with experiments on alundum rods excited in longitudinal resonance. Measured losses in the fluid-saturated rods greatly exceeded the computed values. However, there was indication that an air saturation of a few percent remained after the best effort at fluid saturation, which means that the experimental conditions were not the same as those assumed for the calculations. GRA

N78-24740# Bureau of Mines, Washington, D. C.

BARITE: A STATISTICAL SUMMARY

Stanley K. Haines 1978 31 p refs

(PB-277220; BM-IC-8763) Avail: NTIS HC A03/MF A01 CSCL 08F

Because of the increasing importance of barite, the Bureau of Mines has compiled 19 tables of data concerning production, consumption, imports, and world production for the years 1880 to 1976. Barite is vital to the petroleum industry, with 90% of domestic consumption used in drilling muds. Production has traditionally fallen short of consumption and in 1976, 41% of the 2.2 million tons consumed was imported. The world production of barite increased from 269,000 tons in 1923 to 5.2 million tons in 1975 but is in danger of falling short of future demand. The compiled data provide a comprehensive base of information. GRA

N78-24741# National Center for Atmospheric Research, Boulder, Colo.

TRAVELING PLANETARY WAVES AND THEIR EFFECT ON THE GENERAL CIRCULATION Ph.D. Thesis

Roland Aloysius Madden 1978 87 p refs

(Grant NSF ATM-77-23757)

(PB-277480; NCAR/CT-47) Avail: NTIS HC A05/MF A01 CSCL 04A

Evidence of regularly propagating, large-scale waves was found in a 73 year record of Northern Hemisphere sea level pressure data and in a nine-year record of upper air data. Cross spectrum analyses indicated that south of 50 N, in all seasons, a zonal wave number one disturbance moves westward around the world in five days. In addition, north of 50 N, primarily in winter and spring, a zonal wave number one disturbance moves westward around the world in one to three weeks with an average period near 16 days. The structure of the 16-day wave during winter was studied, and it was shown to be consistent, in many respects, with that of a theoretically predicted free planetary wave of the second class. Further evidence is presented that demonstrates that the interaction of a transient, free, planetary wave and a quasi-stationary, forced wave can cause large fluctuations in vertical energy transport and in the total atmospheric energy cycle itself. GRA

N78-25044# Joint Publications Research Service, Arlington, Va.

ANNULAR STRUCTURES ON THE EARTH

V. N. Bryukhanov, M. Z. Glukhovskiy, and A. L. Stavtsev *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 30 (JPRS-707141), 2 Mar. 1978 p 78-93 refs Transl. into ENGLISH from Priroda (Moscow), no. 10, 1977 p 54-65

(For availability see N78-25037 15-99)
Copyright. Avail: NTIS HC A06/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N78-24742# National Environmental Satellite Service, Washington, D. C.
KEY TO METEOROLOGICAL RECORDS DOCUMENTATION NO. 5.4: ENVIRONMENTAL SATELLITE IMAGERY, SEPTEMBER 1977
Environ. Data Service Dec. 1977 96 p refs
(NOAA-S/T-78-89) Avail: NTIS HC A05/MF A01

Daily mosaics are presented for the Northern and Southern Hemispheres. These were prepared from data swaths by a scanning radiometer on the NOAA 2, 3, 4, and 5 satellites. Author

N78-24743*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN ANALYSIS OF MAXIMUM HORIZONTAL WIND SPEEDS AND ASSOCIATED PARAMETERS RECORDED AT NASA'S 150-METER GROUND WINDS TOWER FACILITY AT KENNEDY SPACE CENTER, FLORIDA
Margaret B. Alexander Mar. 1978 57 p refs
(NASA-TM-78170) Avail: NTIS HC A04/MF A01 CSCL 04B

Continuous horizontal wind speed measurements were processed and classified as a function of tower level (10, 18, 60, and 150 meters) and period of reference [day, month, season: winter (October through March) and summer (April through September), and annual]. Tabulations were made of the daily maximum horizontal wind speed, time of ocurrence, and five associated parameters: mean horizontal wind speed, maximum vertical gusts (i.e., updraft and downdraft), and mean and instantaneous directions. Analyses using these data included means, extremes, standard deviations, and frequency distributions. Comparisons of intensity of maximum horizontal wind speeds determined in this year of data are made with maximum values recorded at Kennedy Space Center during another non-hurricane-occurrence year (1967) and with values during 1966 through 1972 when six hurricanes affected the area after the Ground Winds Tower facility became operational. Wind flow in the lowest 150 meters of the atmosphere was measured for the identification of hazards involved in wind shear encounter relative to ascent and descent of the space shuttle and conventional aircraft. Author

N78-24744*# City Coll. of the City Univ. of New York.
EXPERIMENTS IN MONTHLY MEAN SIMULATION OF THE ATMOSPHERE WITH A COARSE-MESH GENERAL CIRCULATION MODEL
Robert J. Lutz and J. Spar May 1978 48 p refs
(Grant NGR-33-016-086)
(NASA-CR-157103) Avail: NTIS HC A03/MF A01 CSCL 04B

The Hansen atmospheric model was used to compute five monthly forecasts (October 1976 through February 1977). The comparison is based on an energetics analysis, meridional and vertical profiles, error statistics, and prognostic and observed mean maps. The monthly mean model simulations suffer from several defects. There is, in general, no skill in the simulation of the monthly mean sea-level pressure field, and only marginal skill is indicated for the 850 mb temperatures and 500 mb heights. The coarse-mesh model appears to generate a less satisfactory monthly mean simulation than the finer mesh GISS model. Author

N78-24745# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie.
METEOROLOGICAL DATA, NEW SERIES B BASIC MATERIAL. VOLUME 7, NO. 1: AEROLOGICAL DATA BERLIN-TEMPELHOF, JANUARY - JUNE 1976 [METEOROLOGISCHE ABHANDLUNGEN, NEUE FOLGE SERIE B GRUNDLAGENMATERIAL. BAND 7, HEFT 1: AEROLOGISCHE DATEN BERLIN-TEMPELHOF, JANUAR - JUNI 1976]
1977 256 p In GERMAN; ENGLISH summary
Avail: NTIS HC A12/MF A01

The detailed results of the radiosonde ascents performed by the aerological station are presented in tabular and graphical form. Extreme and mean values of the temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature, and velocity of sound, were extracted for all standard pressure surfaces, several height levels, the tropopause, and the freezing level. Author

N78-24746# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie.
METEOROLOGICAL DATA, NEW SERIES B BASIC MATERIAL. VOLUME 8, NO. 1: DAILY HEIGHT CHARTS OF THE 50 mb LEVEL AS WELL AS MONTHLY MEAN CHARTS FOR THE YEAR 1976, PART 1 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN, NEUE FOLGE SERIE B GRUNDLAGENMATERIAL. BAND 8, HEFT 1: TAEGLICHE HOHENKARTEN DER 50-MB-FLACHE SOWIE MONATLICHE MITTELKARTEN FUER DAS JAHR 1976, TEIL 1, 1. VIERTELJAHR]
1976 130 p In GERMAN; ENGLISH summary
(QR-1-Pt-1) Avail: NTIS HC A07/MF A01

The present volume continues the series of stratospheric weather maps published since 1957 in the Meteorologische Abhandlungen of the Meteorological Institute of the Free University. It contains daily height and temperature analyses of constant pressure levels for three months for the whole of the northern hemisphere, based on rawinsonde and in the upper stratosphere also on rocketsonde data and performed with the aid of a hydrostatic build-up method. The corresponding monthly mean maps, their variations and deviations are included as well as the mean gridpoint data, calculated from daily values. Moreover, the stratospheric circulation of polar, middle, and tropical latitudes is described for the period under consideration. Author

N78-24747# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie.
METEOROLOGICAL DATA, NEW SERIES B BASIC MATERIAL. VOLUME 8, NO. 2: DAILY HEIGHT CHARTS OF THE 50 mb LEVEL AS WELL AS MONTHLY MEAN CHARTS FOR THE YEAR 1976, PART 2 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN, NEUE FOLGE SERIE B GRUNDLAGENMATERIAL. BAND 8, HEFT 2: TAEGLICHE HOHENKARTEN DER 50-MB-FLACHE SOWIE MONATLICHE MITTELKARTEN FUER DAS JAHR 1976, TEIL 2, 2. VIERTELJAHR]
1976 124 p In GERMAN; ENGLISH summary
(QR-2-Pt-2) Avail: NTIS HC A06/MF A01

For abstract, see N78-24746.

N78-24748# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie.
METEOROLOGICAL DATA, NEW SERIES B BASIC MATERIAL, VOLUME 9, NO. 1. DAILY HEIGHT CHARTS OF THE 50 mb LEVEL AS WELL AS MONTHLY MEAN CHARTS FOR THE YEAR. PART 1: WORKING GROUP STRATOSPHERE Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN, NEUE FOLGE SERIE B GRUNDLAGENMATERIAL. BAND 9, HEFT 1: TAEGLICHE HOHENKARTEN DER 30-MB-FLACHE SOWIE MONATLICHE MITTELKARTEN FUER DAS JAHR 1976, TEIL 1, 1. VIERTELJAHR]
1976 125 p In GERMAN; ENGLISH summary
(QR-1-Pt-1) Avail: NTIS HC A06/MF A01

The present volume continues the series of stratospheric weather maps published since 1957. It contains daily height and temperature analyses of constant pressure levels for three months for the whole of the northern hemisphere, based on rawinsonde and in the upper stratosphere also on rocketsonde data and performed with the aid of a hydrostatic build-up method. The corresponding monthly mean maps, their variations and deviations are included as well as the mean gridpoint data, calculated from daily values. Moreover, the stratospheric circulation of polar, middle, and tropical latitudes is described for the period under consideration. Author

N78-24749# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie

METEOROLOGICAL DATA, NEW SERIES B BASIC MATERIAL. VOLUME 9, NO. 2: DAILY HEIGHT CHARTS OF THE 30 mb LEVEL AS WELL AS MONTHLY MEAN CHARTS FOR THE YEAR 1976, PART 2 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN, NEUE FOLGE SERIE B GRUNDLAGENMATERIAL. BAND 9, HEFT 2: TAEGLICHE HOHENKARTEN DER 30-MB-FLACHE SOWIE MONATLICHE MITTELKARTEN FUER DAS JAHR 1976, TEIL 2, 2. VIERTELJAHR]

1976 82 p In GERMAN; ENGLISH summary
(QR-2-Pt-2) Avail: NTIS HC A05/MF A01

For abstract, see N78-24748.

N78-24750# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie.

METEOROLOGICAL DATA, NEW SERIES B BASIC MATERIAL. VOLUME 10, NO. 4: THE EUROPEAN CLIMATOLOGY 1976: METEOROLOGICAL SATELLITE DATA FROM THE BERLIN ZONE OF RECEPTION, PART 4 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN, NEUE FOLGE SERIE B GRUNDLAGENMATERIAL. BAND 10, HEFT 4: DAS EUROPAISCHE WETTERBILD 1976 WETTERSATELLITEN-DATEN AUS DEM BERLINER EMPFANGSBEREICH, TEIL 4, 4. VIERTELJAHR]

1976 206 p In GERMAN
(QR-4-Pt-4) Avail: NTIS HC A10/MF A01

Daily mosaics are presented for the Northern Hemisphere with emphasis on Europe. These were prepared from data swaths by scanning radiometers on NOAA 4 and NOAA 5 satellites.
Author

N78-24751# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie.

METEOROLOGICAL DATA, NEW SERIES B BASIC MATERIAL. VOLUME 10, NO. 3: THE EUROPEAN CLIMATOLOGY 1976: METEOROLOGICAL SATELLITE DATA FROM THE BERLIN ZONE OF RECEPTION, PART 3 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN, NEUE FOLGE SERIE B GRUNDLAGENMATERIAL. BAND 10, HEFT 3: DAS EUROPAISCHE WETTERBILD 1976 WETTERSATELLITEN-DATEN AUS DEM BERLINER EMPFANGSBEREICH, TEIL 3, 3. VIERTELJAHR]

1976 204 p refs In GERMAN
(QR-3-Pt-3) Avail: NTIS HC A10/MF A01

For abstract, see N78-24750.

N78-24752*# ITT Aerospace/Optical Div., Fort Wayne, Ind.

ADVANCED METEOROLOGICAL TEMPERATURE SOUNDER (AMTS) STUDY Final Report

10 Nov. 1977 109 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954788)
(NASA-CR-157083) Avail: NTIS HC A06/MF A01 CSCL 04B

The results of a system definition study (theoretical) for an Advanced Meteorological Temperature Sounder (AMTS) is described. From the data the atmospheric temperature and humidity profiles can be determined over the entire earth's surface with a spatial resolution of 45 km. x 45 km; amounts and type of cloud cover as well as surface temperatures of the earth are also determined. The major purpose of the study was to determine the feasibility of cooling twenty-eight detectors to the 80-90 Kelvin region by means of a radiative cooler. Other related considerations were achieving high signal-to-noise ratios, maximizing optical throughput through the grating spectrometer, and reducing preamplifier noise. A detailed optical design of an f/5 Ebert-Fastie spectrometer was carried out to verify that image quality is adequate; field lenses near the spectrometer focal plane were designed to image the grating onto the smallest size detectors for each channel.
Author

N78-24753*# Raytheon Co., Sudbury, Mass. Electro-Optics Dept.

CAT LIDAR WIND SHEAR STUDIES

Roger W. Goff 1 Mar. 1978 34 p refs
(Contract NAS8-28424)
(NASA-CR-150622; ER78-4081) Avail: NTIS HC A03/MF A01 CSCL 04B

The studies considered the major meteorological factors producing wind shear, methods to define and classify wind shear in terms significant from an aircraft perturbation standpoint, the significance of sensor location and scan geometry on the detection and measurement of wind shear, and the tradeoffs involved in sensor performance such as range/velocity resolution, update frequency and data averaging interval.
Author

N78-24754*# City Coll. of the City Univ. of New York. Dept. of Earth and Planetary Sciences.

SIMULATIONS OF THE MONTHLY MEAN ATMOSPHERE FOR FEBRUARY 1976 WITH THE GISS MODEL

Jerome Spar and Robert J. Lutz [1978] 39 p refs
(Grant NGR-33-013-086)
(NASA-CR-157158; Contrib-105) Avail: NTIS HC A03/MF A01 CSCL 04B

Monthly mean simulations of the global atmosphere were computed for February 1976 with the GISS model from observed initial conditions. In a replication experiment, two of these computations generated slightly different monthly mean states, apparently due to the schedule of interruptions on the computer. The root-mean-square errors of replication over the Northern Hemisphere were found to be about 2 mb, 20 m, and 1 K for sea-level pressure, 500 mb height, and 850 mb temperature, respectively. The monthly mean 500 mb forecast results for February 1976 over the Northern Hemisphere were consistent with those from earlier GISS model experiments.
Author

N78-24755# Toronto Univ. (Ontario). Inst for Aerospace Studies.

THE EFFECTS OF WIND SHEAR ON AIRCRAFT FLIGHT PATH AND METHODS FOR REMOTE SENSING AND REPORTING OF WIND SHEAR AT AIRPORTS

Gaston Beaulieu Feb. 1978 61 p refs
(UTIAS-TN-216; CN-ISSN-0082-5263) Avail: NTIS HC A04/MF A01

Strong wind shear can cause large flight path disturbances with modern jet transport aircraft. The meteorological conditions causing wind shear and aircraft response to wind shear are described in general terms to provide a basic understanding of the wind shear phenomenon. The dynamic response of an aircraft/pilot system to wind shear is explained based on one hundred approaches flown with a simple flight simulator in very strong wind shear. The basic philosophy of flight control displays and integrated automatic flight control systems is discussed with regard to enhanced flight path and airspeed control under extreme wind shear conditions. Wind shear remote sensors now under development are briefly described with their limitations, advantages and disadvantages. A complete description of an airborne display for wind shear information and a proposed acoustic Doppler installation in an airport environment conclude the present investigation.
Author

N78-24756# Ecological Enterprises, Inc., Bedford, Mass.

THEORETICAL STUDY OF THREE-DIMENSIONAL SLOPE AND VALLEY WIND SYSTEMS Final Report, 21 Oct. 1975 - 15 Dec. 1977

Wen Tang 12 Dec. 1977 118 p refs
(Contract DAAG29-76-C-0007)
(AD-A051221) Avail: NTIS HC A06/MF A01 CSCL 04/2

A numerical model for studying a three-dimensional mountain-valley wind system over a typical mountain-valley terrain has been developed. This model is non-hydrostatic with Boussinesq approximation. The non-linear interaction between the thermally induced motion in the valley and the wind in the upper troposphere is investigated in a truly three-dimensional sense. The interplay between the slope wind and valley plain wind is examined. Computational results for different surface thermal conditions, geometrical factors of terrain, and meteorological and physical imputs have been obtained. Available observations and analytical theory appear to support several findings in this study. Another important contribution is the development of a method of computing surface temperature and heat flux in a typical valley terrain. This method has taken into consideration both the effect of the shadow cast by the ridge opposite the slope for different times of the day for the incoming solar radiation, and the effect of elevated mountain surface in the calculation of the effective

long-wave radiation at given positions from the valley slope and valley floor. This method has checked well with observations in valleys in Vermont. Author (GRA)

N78-24757# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE METHOD OF EFFECT ON CONVECTIVE CLOUDS WITH THE AID OF SURFACE ACTIVE COMPOUNDS
Ye. Ye. Korniyenko, M. V. Tovbin, and A. I. Furman 3 Jan. 1978 20 p refs Transl. into ENGLISH from Tr. Ukr. Nauch.-Issled. Gidrometeorol. Inst. (USSR), no. 74, 1968 p 99-104
(AD-A051750; FTD-ID(RS)T-2289-77) Avail: NTIS HC A02/MF A01 CSCL 04/2

During the development of the methods of the artificial causing of precipitation, as under the influence on other weather processes, main condition is at present the detection of those components of the process of the formation of the precipitation in which, with the aid of microeffects, it is possible to obtain macroscopic effect. This condition is caused by the facts that energy of precipitation-forming processes considerably exceeds the energy possibilities of contemporary technical means. The difficulty of developing the effective methods of the causing of precipitation is caused also by the facts that the question concerning the mechanism of the natural processes of precipitation formation are still distant at present from solution. GRA

N78-24758# Lockheed Missiles and Space Co., Huntsville, Ala.
VERIFICATION OF WIND MEASUREMENT TO 450-METER ALTITUDE WITH MOBILE LASER DOPPLER SYSTEM Final Report, Jul. 1976 - Mar. 1977
M. R. Brashears and W. R. Eberle Dec. 1977 263 p refs
(Contract DOT-TSC-1190)
(AD-A049944; LMSC-HREC-TR-d497230) Avail: NTIS HC A12/MF A01 CSCL 04/2

The Lockheed mobile atmospheric unit is a laser Doppler velocimeter system designed for the remote sensing of winds. The capability of the laser Doppler velocimeter accurately to measure winds to 150-meter altitude has been previously demonstrated. To assess the capability of the laser Doppler velocimeter to measure winds at higher altitudes, the system was tested adjacent to the 481-meter instrumented WKY-TV television transmission tower at the National Severe Storms Laboratory test site near Norman, Oklahoma. Comparisons between the laser-measured winds and the anemometer-measured winds are presented. The sources of discrepancies between laser-measured wind and anemometer-measured wind are discussed. Author (GRA)

N78-24759# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 12823A LANCE, MISSILE NUMBER 4285, ROUND NUMBER 305 NCL, 7 DECEMBER 1977 Meteorological Data Report
Dec. 1977 38 p
(AD-A052459; DR-954) Avail: NTIS HC A03/MF A01 CSCL 16/4

Meteorological data gathered for the launching of 12823A Lance, Missile Number 4285, Round Number 305 NCL, are presented in tabular form. Author (GRA)

N78-24760# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19301A GSRS, MISSILE NUMBER V-1, ROUND NUMBER V-1, 5 DECEMBER 1977 Meteorological Data Report
Dec. 1977 22 p
(DA Proj. 1T1-65702-D-127)
(AD-A052460; DR-953) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19301A GSRS, Missile Number V-1, Round Number V-1, is presented in tabular form. Author (GRA)

N78-24761# Army Electronics Command, White Sands Missile Range, N. Mex.
THE 12831D LANCE, MISSILE NUMBER 3298, ROUND NUMBER 304 ESL, 3 DECEMBER 1977 Meteorological Data Report
Dec. 1977 38 p refs
(AD-A052461; DR-952) Avail: NTIS HC A03/MF A01 CSCL 16/4

Meteorological data gathered for the launching of 12831D Lance, Missile Number 3298, Round Number 304 ESL, are presented in tabular form. Author (GRA)

N78-24762# Environmental Research and Technology, Inc., Concord, Mass.
PARAMETERIZATION OF WEATHER RADAR DATA FOR USE IN THE PREDICTION OF STORM MOTION AND DEVELOPMENT Final Report, 6 Aug. - 31 Dec. 1976
Robert K. Crane Mar. 1977 104 p refs
(Contract F19628-76-C-0264)
(AD-A052535; ERT-P-2095; AFGL-TR-77-0216) Avail: NTIS HC A06/MF A01 CSCL 04/2

Algorithms were developed for the rapid and efficient representation of digital data from a single Doppler weather radar. The data are processed to obtain a number of attributes which describe small convective cells, larger echo areas, and isolated regions of high tangential shear. The data are also processed to provide estimates of the environmental wind velocity profile and the total reflectivity profile. The attributes are obtained to represent the essential information content of the radar data with the fewest possible number of parameters. The attributes were selected to describe the development and motion of severe storms and, in particular, the small convective elements that are viewed as the building blocks of the storm. Attributes were also selected to describe isolated tangential shear maxima to obtain signatures of storm severity. Author (GRA)

N78-24763# Raytheon Co., Wayland, Mass. Equipment Div.
R AND D EQUIPMENT INFORMATION REPORT: TRACKING AND SIGNIFICANCE ESTIMATOR Final Report, Apr. - Oct. 1977
T I. S. Boak, III, A. J. Jagodnik, Jr., R. B. Marshall, D. Riceman, and M. J. Young 7 Nov. 1977 120 p
(Contract F19628-77-C-0148; AF Proj. 6670)
(AD-A052359; ER77-4283; AFGL-TR-77-0259) Avail: NTIS HC A06/MF A01 CSCL 17/9

Equipment is described which operates on data obtained by a coherent meteorological radar with Doppler pulse pair processor. The Tracking and Significance Estimator (TSE) periodically acquires logarithmic power, mean Doppler velocity, and variance of Doppler velocity for an entire azimuthal antenna scan. The TSE finds the twelve most severe storm cells, computes their reflectivity-weighted centers, then plots the centers and the cell outlines on a color CRT display. Centers from up to 24 previous acquisition intervals, color coded according to acquisition time, are also presented so as to form storm cell tracks.Author (GRA)

N78-24764# Naval Ocean Systems Center, San Diego, Calif.
MARINE FOG INVESTIGATION AT SAN DIEGO DURING CEWCOM-1976. SIMULTANEOUS OBSERVATIONS ON LAND AT NOSC AND BY AIRCRAFT, SHIP, AND SATELLITE DURING THE COOPERATIVE EXPERIMENT IN WEST COAST OCEANOGRAPHY AND METEOROLOGY (SEPTEMBER AND OCTOBER, 1976) REVEALED SIGNIFICANT RELATIONS BETWEEN LOW-LEVEL VERTICAL STRUCTURE, SURFACE AIR FLOW SEA SURFACE TEMPERATURE, AND AREA OF MARINE FOG PATCHES Technical Report, Sep. 1976 - Aug. 1977
V. R. Noonkester 13 Oct. 1977 68 p refs
(WR0330201)
(AD-A052311; NOSC/TR-172) Avail: NTIS HC A04/MF A01 CSCL 04/2

The formation and dissipation of Santa Ana marine fog along the coast of Southern California was investigated, using multiple remote sensor data taken on land at NOSC and other data taken by means of aircraft, ship, and satellite. The simultaneous measurements provided excellent, unique data concerning the horizontal distribution of factors controlling the formation and dissipation of marine fog. Santa Ana marine fog appears to form in regions where the sea surface temperature is decreasing in the direction of air flow and where low-level convergence is present after subsidence aloft has attained a maximum. Satellite and aircraft data can provide valuable information on marine fog over the offshore regions. More information on horizontal

and temporal variation in air flow and sea surface temperature must be considered to improve fog forecasts related to Santa Ana conditions along the coast of Southern California. An unusually detailed sea surface temperature pattern was obtained by aircraft IR data over the ocean near San Diego. Vertical profiles of the horizontal wind measured by acoustic techniques were found to provide valuable information on moisture distribution during one fog event. Author (GRA)

N78-24765# Air Weather Service, Scott AFB, Ill.
GUIDE FOR APPLIED CLIMATOLOGY
Nov. 1977 155 p refs
(AD-A052579; AWS-TR-77-267) Avail: NTIS HC A08/MF A01 CSCL 04/2

This publication is a useful guide to some applied climatological practices utilized by AWS meteorologists in support of military plans and operations. It explains the application of statistics and probability techniques to climatological problem-solving, and provides several examples of methods useful in solving recurring requests. Author (GRA)

N78-24766*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STATISTICAL ANALYSIS OF NOAA SOLAR/WEATHER TAPES. PROGRAM SUMMARY Final Report
G. Goltz, L. M. Kaiser, and H. Weiner Jun. 1977 54 p
(Contract MIPR-Z-70099-5-50352)
(AD-A047357; JPL-5040-39; USCG-D-12-77; CGR/DC-19/76) Avail: NTIS HC A04/MF A01 CSCL 09/2

A major mission of the U.S. Coast Guard is the task of providing and maintaining Maritime Aids to Navigation. These aids are located on and near the coastline and inland waters of the United States and its possessions. A computer program, Design Synthesis and Performance Analysis (DSPA), has been developed by the Jet Propulsion Laboratory to demonstrate the feasibility of low-cost solar array/battery power systems for use on flashing lamp buoys. To provide detailed, realistic temperature, wind, and solar insolation data for analysis of the flashing lamp buoy power systems, the two DSPA support computer program sets: MERGE and STAT were developed. A general description of these two packages is presented in this program summary report. The MERGE program set will enable the Coast Guard to combine temperature and wind velocity data (NOAA TDF-14 tapes) with solar insolation data (NOAA DECK-280 tapes) onto a single sequential MERGE file containing up to 12 years of hourly observations. This MERGE file can then be used as direct input to the DSPA program. The STAT program set will enable a statistical analysis to be performed of the MERGE data and produce high or low or mean profiles of the data and/or do a worst case analysis. The STAT output file consists of a one year set of hourly statistical weather data which can be used as input to the DSPA program. GRA

N78-24767# Food and Agriculture Organization of the United Nations, Rome (Italy). Locust Control and Emergency Operations Group.
RAINFALL MONITORING IN THE REGION OF THE NORTH-WEST AFRICAN DESERT LOCUST COMMISSION IN 1976-77. INTEGRATING DATA FROM SYNOPTIC WEATHER STATIONS AND METEOROLOGICAL SATELLITES. DESERT LOCUST SATELLITE APPLICATION PROJECT, STAGE 2
Eric C. Barrett (Bristol Univ., Engl.) May 1977 88 p refs
(AGP-LCC/77/9; AGD(RS)4/77) Avail: NTIS HC A05/MF A01

The background, aims, and objectives of the satellite rainfall monitoring program are reviewed and the structure and accuracy of the rainfall monitoring method in Morocco, Algeria, Libya, and Tunisia are discussed. Operational problems and products are listed and significant rainfall events in the North African desert locust recession area in the winter of 1976 to 1977 are recorded. ESA

N78-24768# Istituto di Fisica Dell Atmosfera, Rome (Italy).
RADAR MEASUREMENTS OF SOME MICROPHYSICAL CLOUD PARAMETERS [MISURE RADAR DI ALCUNI PARAMETRI MICROFISICI DELLE NUBI]
A. Anav, E. Gorgucci, R. M. Leonardi, and G. F. Scarchilli Jan. 1976 13 p refs In ITALIAN
(IFA-SR-41) Avail: NTIS HC A02/MF A01

The determination of the distribution spectrum of the diameters of hydrometeors from radar reflection and attenuation measurements at various wavelengths is discussed. Criterions to select the wavelengths are dealt with, and determination of the dimensions and concentration of hydrometeors is discussed. It is shown that it is possible to choose wavelengths suitable to detect hailstones but the wavelength selection is critical, also for hydrometeors. ESA

N78-24769# Istituto di Fisica Dell Atmosfera, Rome (Italy).
DROP FORMATION AND DROP GROWTH ON AN INSOLUBLE NUCLEUS BY ADIABATIC EXPANSION [FORMAZIONE E CRESCITA DI UNA GOCCIA SU UN NUCLEO INSOLUBILE PER EFFETTO DI UN'ESPANSIONE ADIABATICA]
S. Ascoli, E. Gorgucci, and U. Ricci Jul. 1977 27 p refs In ITALIAN
(IFA-SR-43) Avail: NTIS HC A03/MF A01

The formation and growth of a drop on an insoluble nucleus by adiabatic expansion, which is postulated as slow so that reversibility can be assumed, was studied theoretically. Reversibility permits the rather simple determination of the relationships between the parameters of state of the system drop-environment and the radius of the drop as a function of the environment pressure. It was found that, under circumstances discussed, the radius of the drop varies between 2.5 and 25.5 microm. ESA

N78-24770# Institut Royal Meteorologique de Belgique, Brussels.
FOG FREQUENCY IN BELGIUM [LA FREQUENCE DU BROUILLARD EN BELGIQUE]
A. Bodeux 1977 40 p In FRENCH and DUTCH
(Misc-Ser-B-44) Avail: NTIS HC A03/MF A01

Monthly and annual frequencies of mist over Belgium are given for 06, 12, and 18 hrs U.T. from 16 stations for the period 1952 to 1975. Results are given in tabular form. ESA

N78-24771# Royal Netherlands Meteorological Inst., De Bilt.
OCCURRENCE AND ADVECTION OF FOG AT AMSTERDAM/AIRPORT (SCHIPHOL)
F. Cannemeijer and A. H. C. Stalenhoef 1977 67 p refs
(KNMI-WR-77-12) Avail: NTIS HC A04/MF A01

Following a short discussion of the occurrence of fog at Amsterdam Schiphol airport and a description of two local automatic stations, a classification of fogs into advection and radiation is described. The number and duration of fogs at Schiphol during the past two years are given and the effects on temperature, humidity, and occurrence of radiation fog by urban areas are discussed. A comparison of visibility in the area is made and finally the advection of fog is studied. ESA

N78-24772# Societe Nationale Industrielle Aerospatiale, Paris (France).
ONE DIMENSIONAL THERMAL MODEL [MODELE THERMIQUE UNIDIMENSIONNEL]
Joseph Bensimon and Bernard Dehove Assoc. Aeron. et Astronautique de France 29 Apr. 1977 161 p refs In FRENCH Presented to Comite pour l'Anal. des Consequences des Vols Stratospheriques.
(AAAF-NT-77-45; COVOS-6B; ISBN-2-7170-0470-X) Avail: NTIS HC A08/MF A01; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

A natural atmospheric model for the vertical temperature distribution as a function of the main physical parameters of the atmosphere and of the vertical profiles of the optical active constituents is presented. Topics include theoretical study of radiative transfer, solar radiation, terrestrial radiation, radiation equilibrium with convection adjustment, atmospheric perturbation, and limits inherent to one-dimensional models. ESA

N78-24773 National Technical Information Service, Springfield, Va.
HAIL: METEOROLOGY, DAMAGE, PREVENTION, AND FORECASTING. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974 - Feb. 1978
Robena J. Brown Mar. 1978 281 p Supersedes NTIS/PS-77/0260 and NTIS/PS-76/0256
(NTIS/PS-78/0257; NTIS/PS-77/0260; NTIS/PS-76/0256)

Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

Research includes data on hail storms, formation, damage, and warning systems. The atmospheric and cloud physics associated with hail tracking, forecasts, erosion, and meteorological instruments used for measurement are cited. Studies on meteorological fronts and storms which accompany hail and methods to modify these systems are also cited. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N78-24774# National Physical Research Lab., Pretoria (South Africa).

REPORT ON NIMBUS THE NPRL PARTICIPATION ON G PRELAUNCH SEA TRUTH EXPERIMENTS: CRUISE 20-23 JUNE 1977

H. Vanderpiepen 1977 19 p

(FIS-138; ISBN-0-7988-1173-0) Avail: NTIS HC A02/MF A01

The scientific purpose of the cruise was: (1) to relate surface temperatures to radiometric temperature determinations made on board, from a low-flying aircraft and from a NOAA satellite; (2) to take temperature profiles; (3) to collect water samples from different depths if the water was found to contain any major constituents of interest to this experiment; (4) to do optical measurements in the water. The route followed was a square-like track (including the diagonal) with stations on each of the four corners and halfway in between. The aircraft had to follow the same track, but in addition cover a much larger area which formed a meander-like pattern. Unfortunately, the experiment was seriously hampered by bad weather conditions, in particular by cloud cover, rain, wind and a very rough sea. As a result, shipborne measurements were taken only on 1 1/2 days airborne measurements were taken on one day and useful satellite data can be expected from only one day's measurements. Author

N78-24775*# City Coll. of the City Univ. of New York. Inst. of Marine and Atmospheric Sciences.

VERIFICATION RESULTS FOR THE SPECTRAL OCEAN WAVE MODEL (SOWM) BY MEANS OF SIGNIFICANT WAVE HEIGHT MEASUREMENTS MADE BY THE GEOS-3 SPACECRAFT Final Report

Willard J. Pierson and Robert E. Salfi May 1978 238 p refs (Contract NAS6-2439)

(NASA-CR-62089) Avail: NTIS HC A11/MF A01 CSCL 08C

Significant wave heights estimated from the shape of the return pulse wave form of the altimeter on GEOS-3 for forty-four orbit segments obtained during 1975 and 1976 are compared with the significant wave heights specified by the spectral ocean wave model (SOWM), which is the presently operational numerical wave forecasting model at the Fleet Numerical Weather Central. Except for a number of orbit segments with poor agreement and larger errors, the SOWM specifications tended to be biased from 0.5 to 1.0 meters too low and to have RMS errors of 1.0 to 1.4 meters. The much fewer larger errors can be attributed to poor wind data for some parts of the Northern Hemisphere oceans. The bias can be attributed to the somewhat too light winds used to generate the waves in the model. Other sources of error are identified in the equatorial and trade wind areas. Author

N78-24776*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

GEOS-3 OCEAN GEOID INVESTIGATION

S. M. Yionoulis, A. Eisner, V. L. Pisacane, H. D. Black, and L. L. Pryor May 1978 35 p refs

(NASA Order P-57606-G)

(NASA-CR-141440) Avail: NTIS HC A03/MF A01 CSCL 08J

A determination of the fine scale sea surface topography in the GEOS-3 calibration area using the radar altimeter data is presented. Estimates of the north-south and east-west components of the deflections of the vertical as well as values of the geoidal heights were made. Three major stages of processing were used in obtaining the final results. The first two use pass processors; in the final stage, the processor combines all the pass results to compute the final results. The results obtained compare favorably with gravimetrically determined geoids for this calibration area. Author

N78-24777# Texas Univ., Austin.

RESULTS OF A STUDY OF THE OCEAN BOTTOM INTERACTION OF UNDERWATER SOUND

Kenneth E. Hawker, , Karl Focke, Terry Foreman, Steven R. Rutherford, and Winifred Williams 25 Oct. 1977 180 p refs (Contract N00039-76-C-0081)

(AD-A052295; ARL-TR-77-27) Avail: NTIS HC A09/MF A01 CSCL 20/1

This report describes the research of the second year of an on-going program to investigate the broad spectrum of problems associated with the interaction of underwater sound with the ocean bottom. The emphasis is on quantifying the nature of the acoustic bottom interaction problem, isolating key parameters, and developing useful minimal descriptions. This report considers in detail questions in the areas of the sensitivity of bottom reflection loss to variations in subbottom parameters, the sensitivity of propagation loss to changes in bottom reflection loss, and problem associated with range changing bathymetry. Additional topics considered include a review of acoustic methods for obtaining bottom sediment sound velocities, as well as various modeling problems. Author (GRA)

N78-24778# Istituto di Fisica Dell Atmosfera, Rome (Italy).

ON THE MELLOR-DURBIN THEORY OF MARINE THERMOCLINE

E. Salusti (Rome Univ.), R. Purini, and A. Rovelli (Rome Univ.) Mar. 1977 22 p refs Sponsored by CNR

(IFA-RDP-67) Avail: NTIS HC A02/MF A01

It is shown that when the temperature vertical profiles, the surface heating, and the wind stress values experimentally derived are inserted in the Mellor Durbin model of the marine thermocline, an algebraic equation for turbulent kinetic energy results, as well as for shear, buoyancy, and dissipation. Each quantity is given locally in time and depth but there is no depth-average. The validity of the procedure and its precision are discussed. ESA

N78-24779# Istituto di Fisica Dell Atmosfera, Rome (Italy).

EMPIRICAL MODELS FOR THE STUDY OF THE MARINE MIXED LAYER [MODELLI EMPIRICI PER LO STUDIO DEL MIXED LAYER MARINO]

Roberto Benzi Sep. 1977 66 p refs In ITALIAN Sponsored by CNR

(IFA-RDP-69) Avail: NTIS HC A04/MF A01

Various types of empirical approximations for the equations of motion in a turbulent fluid, representing the surface sea layer or marine mixed layer, were studied. In particular, the model of Mellor et al. on the formation and dynamic development of the mixed layer was used. Other topics dealt with include Reynolds equations, viscosity coefficients, and Richardson number. ESA

N78-24780# The Research Inst. of the Gulf of Maine, South Portland.

DIRECTORY OF MARINE RESEARCH FACILITIES AND PERSONNEL IN MAINE

Diane S. Brackett, ed. and Karen R. Moore, ed. Jan. 1978 168 p Prepared in cooperation with Maine Dept. of Marine Resources, Augusta

(PB-278288; NOAA-78022403) Avail: NTIS HC A08/MF A01 CSCL 05A

Personnel entries are included, most of which list research interests, research project titles, and project descriptions along with name, title, highest degree, agency or organization, address and phone number. The appendix provided brief descriptions of academic facilities offering marine related courses. Information concerning marine summer courses, laboratories, special facilities and equipment, related courses, faculty and research in progress is presented in detail for each institution. Similar data can be found for various independent, state and industrial commercial organizations. There is also listed aquacultural organizations and fishermen's cooperatives in the state. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N78-24781*# National Aeronautics and Space Administration, Washington, D. C.
BEFORE THE LONG JOURNEY
Oleg Georgiyevich Gazenko May 1978 20 p Transl. into ENGLISH from Nauka Zhizn (USSR), no. 11, Nov. 1977 p 33-39 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. of Med. Biol. Probl. of the Min. of Public Health USSR
(Contract NASw-2790)
(NASA-TM-75098) Copyright. Avail: NTIS HC A02/MF A01 CSCL 06C

One of the leading specialists in space biology and medicine Oleg Geogiyevich Gazenko discusses the development of space biology and medicine and the problems which its specialists solve. The application of space medicine discoveries to terrestrial medicine is also discussed. Author

N78-24782*# National Aeronautics and Space Administration, Washington, D. C.
BEFORE THE LONG JOURNEY: DEVELOPMENT OF SOVIET SPACE BIOLOGY AND MEDICINE
Oleg Georgiyevich Gazenko May 1978 18 p Transl. into ENGLISH from Nauka Zhizn (USSR), no. 11, Nov. 1977 p 33-39 Transl. by Sci. Transl. Serv., Santa Barbara, Calif. Original doc. prep. by Inst. of Med. and Bio. Probl. of the USSR Min. of Public Health
(NASA-TM-75099) Copyright. Avail: NTIS HC A02/MF A01 CSCL 06C

Academician O. Gazenko, Chief of the Institute of Biomedical Problems, USSR Ministry of Public Health, reviewed the short but intense history of Soviet research in space biology and medicine. The solid academic approach of the Soviet Academy of Sciences in giving a good start at the very beginning of the space age is stressed and key people and institutions who initiated these studies are named. The basic feature of the first period of space biology is seen as the search for answers to a few fundamental questions of survival in space. It is pointed out that the initiated investigations were replaced by refined, in-depth studies of the biological, biophysical, and biochemical processes in human organism in the space environment and the search for methods which should enable cosmonaut crews to live in space for several years during interplanetary journeys. Discussing the typical problems of this effort, Gazenko each time showed how they benefit medical science and practice in general.Author

N78-24783*# Houston Univ., Tex. Dept. of Biology.
THE ROLE OF CELL MEMBRANES IN THE REGULATION OF LIGNIFICATION IN PINE CELLS Research Progress Report
Donald L. Hendrix Feb. 1978 12 p
(Grant NsG-7300)
(NASA-CR-157156) Avail: NTIS HC A02/MF A01 CSCL 06C

The identity of pine cell membranes bearing PAL enzyme activity, the isolation of a plasma membrane preparation from pine cells for testing as a regulatory barrier in lignification, and the measurement of the geopotential effect in pine stems are presented. A model to describe and predict the interaction of gravity and lignification of higher plants was developed. Author

N78-24784*# California Univ., Berkeley. Environmental Physiology Lab.
METABOLIC AND CARDIOVASCULAR ADAPTATION, MONKEY. NASA SMD 3, PROJECT 76, EXPERIMENT 44 CONDUCTED AT NASA/JSC, 14-25 MAY 1977 Final Report
Nello Pace, Donald F. Rahlmann, Richard C. Mains, Arthur M. Kodama, and Ernest P. McCutcheon 30 Oct. 1977 42 p refs
(Grant NsG-7262)
(NASA-CR-157159; EPL-77-2) Avail: NTIS HC A03/MF A01 CSCL 06C

The biomedical results from an experiment on a monkey subjected to space flight conditions are reported. A background history of the development and testing of an experiment system designed to permit measurement of physiological parameters in subhuman primates during continuous, comfortable, couch restraint for periods of up to 30 days is reviewed. Of major importance in the experimental design of the system was the use of a fiberglass pod, which could be sealed and subdivided into upper and lower parts, to monitor and control the physiological responses for various parts of the animal's body. The experiment was conducted within the Spacelab Simulator for a period of 11 days. Data recorded includes: Spacelab Simulator cabin temperature; ventilation rate; pod internal temperature; fraction percent oxygen; fraction percent carbon dioxide; oxygen consumption rate; carbon dioxide production rate; respiratory quotient; intrathoracic temperature; heart rate; mean aortic pressure; mean ventricular pressure; diurnal variation of parameters measured; comparison of mean preflight, flight, and postflight values of the parameters measured; and correlation matrix for the parameters measured. G.Y.

N78-24785# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GEOPHYSICAL PHONONIC ENERGY AS A SOURCE OF BIOPHYSICAL EFFECTS
Zenon Urbanski 26 Sep. 1977 18 p refs Transl. into ENGLISH of the Conf. paper from the 3rd Intern. Congr. on Psychotronic Res. (Poland), Pt. 1, 27 Jun. - 2 Jul. 1977 p 373-382 Conf. held at Tokyo, 27 Jun. - 2 Jul. 1977
(AD-A051386; FTD-ID(RS)T-1596-77) Avail: NTIS HC A02/MF A01 CSCL 06/3

The intensified energy exchange band, and the differences of the gradients of the component level of the geomagnetic field on the surface of the ground, and the associated phenomena of pathology in living matter, as well as the disturbance in inanimate matter, arise especially in underflow of deep sub-surface water. They are known as the source of biophysical effects, whereas the mechanics of this phenomena, its analyzed observation and measurement constitute the subject of this article. GRA

N78-24786# National Technical Information Service, Springfield, Va.
BIOLOGICAL PRODUCTIVITY IN FRESH WATER ENVIRONMENTS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Feb. 1976 - Mar. 1978
Elizabeth A. Harrison Mar. 1978 193 p Supersedes NTIS/PS-77/0267; NTIS/PS-76/0056
(NTIS/PS-78/0293; NTIS/PS-77/0267; NTIS/PS-76/0056) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 06C

Water pollution effects, ecology, ecosystems, seasonal variations, nutrients, eutrophication, food chains and limnology, as related to fresh water biological productivity, are the subjects covered by the selected abstracts of research reports in the bibliography. GRA

N78-24787# Yugoslav Academy of Sciences and Arts, Zagreb.
BIOLOGICAL EFFECTS OF MANGANESE
Marko Saric Jan. 1978 169 p refs
(PB-277169; EPA-600/1-78-001) Avail: NTIS HC A08/MF A01 CSCL 06C

The effects of manganese on the central nervous system and on blood pressure as well as a possible catalytic effect of dust containing manganese on the conversion of sulfur dioxide in the air was considered. The results obtained show that the rate of pneumonia is influenced by the exposure to manganese at the level of occupational exposure in the production of manganese alloys. The study also indicated that a higher rate of chronic nonspecific lung disease can be expected in occupational exposure at this level. At the level of occupational exposure a hypotonic effect on systolic blood pressure was observed. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N78-24788# National Inst. for Occupational Safety and Health, Cincinnati, Ohio.
OCCUPATIONAL EXPOSURE TO DECOMPOSITION PRODUCTS OF FLUOROCARBON POLYMERS. CRITERIA FOR A RECOMMENDED STANDARD
Sep. 1977 121 p refs
(Contract CDC-99-74-31)
(DHEW/Pub/NIOSH-77/193) Avail: NTIS MF A01; HC SOD

The standard is designed to protect the health and provide for the safety of employees for up to a 10 hour work shift, 40 hour workweek, over a working lifetime. The recommended standard for the decomposition products of fluorocarbon polymers emphasizes good work practices and engineering controls and medical management. Since no measurable environmental level of any single decomposition product of fluorocarbon polymers can ensure complete protection of worker health, no occupational exposure limit is recommended in this document. Author

N78-24789# National Inst. for Occupational Safety and Health, Cincinnati, Ohio.
OCCUPATIONAL EXPOSURE TO POLYCHLORINATED BIPHENYLS (PCBS). CRITERIA FOR A RECOMMENDED STANDARD
Sep. 1977 233 p refs
(DHEW/Pub/NIOSH-77/225) Avail: NTIS MF A01; HC SOD

The National Institute for Occupational Safety and Health (NIOSH) recommends that employee exposure to polychlorinated biphenyls (PCBs) in the workplace be controlled by adherence to certain guidelines. The standard used is designed to protect the health and provide for the safety of employees for up to a 10 hour workday, 40 hour workweek, over a normal working lifetime. The standard is measurable by techniques that are valid, reproducible, and available to industry and governmental agencies. Compliance with the standard should substantially reduce any risk of reproductive or tumorigenic effects of PCBs and prevent other adverse effects of exposure in the workplace. Employees should regard the recommended workplace environmental limit as the upper boundary for exposure and make every effort to keep exposure as low as possible. Author

N78-24790# National Inst. for Occupational Safety and Health, Cincinnati, Ohio.
OCCUPATIONAL EXPOSURE TO REFINED PETROLEUM SOLVENTS. CRITERIA FOR A RECOMMENDED STANDARD
Jul. 1977 256 p refs
(Contract CDC-99-74-31)
(DHEW/Pub/NIOSH-77/192) Avail: NTIS MF A01; HC SOD

The National Institute for Occupational Safety and Health recommends standards to protect employees from exposure to petroleum ether, rubber solvent, varnish makers' and painters' naphtha, mineral spirits, Stoddard solvents and kerosene in the workplace. The standards are designed to protect the health and provide for the safety of employees for up to a 10 hour work shift, 40 hour workweek, over a working life. Compliance with all sections of the standards should prevent adverse effects of these chemicals on the health of employees and provide for their safety. Techniques recommended are valid, reproducible, and available to industry and government agencies. Sufficient technology exists to permit compliance with the recommended standards. Although the environmental limits for the workplace are considered to be safe levels based on current information, the employer should regard these as the upper boundary of exposure and every effort should be made to keep the exposure as low as is technically feasible. Author

N78-24791# National Inst. for Occupational Safety and Health, Cincinnati, Ohio.
OCCUPATIONAL EXPOSURE TO VANADIUM. CRITERIA FOR A RECOMMENDED STANDARD
Aug. 1977 151 p refs
(Contract CDC-99-74-31)
(DHEW/Pub/NIOSH-77/222) Avail: NTIS MF A01; HC SOD

The National Institute for Occupational Safety and Health (NIOSH) recommends, standards to protect employer from exposure to vanadium and its compounds in the workplace. The standard is designed to protect the health and provide for the safety of employees for up to a 10 hour work shift, 40 hour workweek, over a working lifetime. Compliance with all sections of the standard should prevent adverse effects of vanadium and its compounds on the health of workers and provide for their safety. Sufficient technology exists to permit compliance with the recommended standard. Although NIOSH considers the workplace environmental limit to be a safe level based on current information, the employer should regard it as the upper boundary of exposure and make every effort to maintain the exposure as low as is technically feasible. Author

N78-24792# National Inst. for Occupational Safety and Health, Cincinnati, Ohio.
OCCUPATIONAL EXPOSURE TO TUNGSTEN AND CEMENTED TUNGSTEN CARBIDE
Sep. 1977 182 p refs
(DHEW/Pub/NIOSH-77/127) Avail: NTIS MF A01; HC SOD

The criteria and the recommended standard based thereon that were prepared to meet the need for preventing occupational disease or injury arising from exposure to tungsten, tungsten compounds, and cemented tungsten carbide are presented. Compounds, or cemented tungsten carbide is the potential for transient or permanent pulmonary damage. Irritation of the skin and upper and lower respiratory tract has also been associated with inhalation of, or skin contact with, these materials and should be considered in any work practices program. Author

N78-24793# Battelle Pacific Northwest Labs., Richland, Wash.
BIOLOGICAL EFFECTS OF STATIC AND LOW-FREQUENCY ELECTROMAGNETIC FIELDS: AN OVERVIEW OF UNITED STATES LITERATURE
R. D. Phillips and W. T. Kaune Jul. 1977 37 p refs
(Contract EY-76-C-06-1830)
(EPRI-EA-490-SR) Avail: NTIS HC A03/MF A01

Data are reviewed from past and ongoing research in the United States concerned with the biological effects of static and low-frequency electromagnetic fields produced by power transmission systems and low frequency communication systems. ERA

N78-24794# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
THE PSYCHOLOGICAL SIGNIFICANCE OF THE ELECTROENCEPHALOGRAM [DE PSYCHOLOGISCHE BETEKENIS VAN HET EEG]
A. W. K. Gaillard 1977 33 p refs In DUTCH Submitted for publication
(IZF-1977-6; TDCK-69120) Avail: NTIS HC A03/MF A01

The possibility of investigating the relationship between brain activity and the psychological functioning of a subject by analyzing the systematic changes in the EEG during the performance of the task is discussed. Topics dealt with include spontaneous brain activity, alpha rhythm, evoked potentials, motor potentials, slow brain potentials, EEG and psychological information processing, selection attention, and stimulus anticipation versus motoric preparation. ESA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

No abstracts in this category.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N78-24795 South African Bureau of Standards, Pretoria.
STANDARD SPECIFICATION FOR THE PRODUCTION OF MEN'S DERBY TYPE SAFETY BOOTS (SEWN, RIVETED, SCREWED, AND STITCHED)
Nov. 1977 47 p Revised Supersedes SABS-437-1953
(SABS-437-1977; ISBN-0-626-04474-X; SABS-437-1953) Copyright. Avail: Issuing Activity

Specifications are given for six types of men's derby type safety boots that are made according to combinations of the sewn, riveted, screwed, and stitched principles. Specifications include: type and method of construction; materials and components; constructional requirements; workmanship and finish; and sampling to comply with the specification. Author

N78-24796 South African Bureau of Standards, Pretoria.
STANDARD SPECIFICATION FOR SAFETY BELT ASSEMBLIES, HARNESSES, AND LAP BELTS FOR USE IN MOTOR VEHICLES
Jun. 1977 45 p In ENGLISH and AFRIKAANS Revised Supersedes SABS-724-1962
(SABS-724-1977; ISBN-0-626-04342-5; SABS-724-1962) Copyright. Avail: Issuing Activity

Requirements are given for the general design, quality of components, and performance of restraining devices for occupants of motor vehicles. The devices may include emergency and automatic retracting and locking retractors. Author

N78-24797# Civil Aeromedical Inst., Oklahoma City, Okla.
PASSENGER FLOW RATES BETWEEN COMPARTMENTS: STRAIGHT-SEGMENTED STAIRWAYS, SPIRAL STAIRWAYS, AND PASSAGEWAYS WITH RESTRICTED VISION AND CHANGES OF ATTITUDE
D. W. Pollard, J. D. Garner, J. G. Blethrow, and D. L. Lowrey Jan. 1978 55 p ref
(AD-A051485; FAA-AM-78-3) Avail: NTIS HC A04/MF A01 CSCL 01/2

Movement was compared up and down spiral and straight segmented stairways simulating the stairs in multideck transport aircraft, up and down spiral and straight-segmented industrial-type stairways, fore and aft through a passageway enclosed on one side, and fore and aft through a passageway enclosed on both sides. An evacuation simulator was positioned to represent degrees of pitch and roll similar to those encountered in accidents as a result of landing gear failure. Tests were conducted in regular cabin lighting, reduced cabin lighting, reduced cabin lighting with subjects wearing goggles simulating smoke conditions, and artificial smoke conditions. Results indicate that an enclosed passageway enables more rapid movement from one compartment to another than does a passageway enclosed on only one side. Straight-segmented stairways allowed more efficient movement from one level to another than did spiral stairs. Author

N78-24798# Civil Aeromedical Inst., Oklahoma City, Okla.
EVALUATION OF SEATING AND RESTRAINT SYSTEMS AND ANTHROPOMORPHIC DUMMIES CONDUCTED DURING FISCAL YEAR 1976
Richard F. Chandler and Edwin M. Trout Feb. 1978 44 p
(AD-A051691; FAA-AM-78-6) Avail: NTIS HC A03/MF A01 CSCL 05/5

The results of test programs conducted by the Protection and Survival Laboratory to investigate the performance of prototype or operational seating and restraint systems relative to their ability to provide protection against crash injury and to investigate the performance of anthropomorphic dummies in the dynamic environment are reported. Author

N78-24799# National Inst. for Occupational Safety and Health, Cincinnati, Ohio.
PROCEEDINGS OF THE INTERNATIONAL OCCUPATIONAL HAND-ARM VIBRATION CONFERENCE
D. E. Wasserman, ed. and W. Taylor, ed. Apr. 1977 261 p refs Proc. held in Cincinnati, 28-31 Oct. 1975
(DHEW/Pub/NIOSH-77/170) Avail: NTIS MF A01; SOD HC

Presentations encompassed the medical, physiological, epidemiological, engineering, and monitoring aspects of the hand-arm vibration problem. Presentations clarified the general hand-arm vibration problem, relating it, but not limiting it, to workers using chain saws. Author

N78-24800# Essex Corp., Alexandria, Va.
HUMAN FACTORS ENGINEERING. PART 1: TEST PROCEDURES Final Report
James C. Perkins, George C. Maxey, Thomas B. Malone, Sheldon W. Shenk, and Mark Kirkpatrick, III 20 Dec. 1977 354 p refs
(Contract DAAD05-76-C-0787)
(AD-A051481; TECOM-TOP-1-2-610-Pt-1) Avail: NTIS HC A16/MF A01 CSCL 05/5

The material in this Test Operations Procedure (TOP) is intended to be used for the Human Factors Engineering (HFE) assessment of all types of materiel and systems tested by TECOM. Supplementary sources of guidance are indicated when required. It encompasses the HFE procedures for the testing of design, functional performance, and environmental considerations for the major test functions (operability, maintainability, transportability, portability/usability, erectability, and habitability) applicable to the HFE assessment. Part 1 of this TOP provides guidance on how to plan and conduct an HFE test. This part also includes specific test procedures and sample data collection forms, such as checklists, questionnaire/interview sheets and other data collection forms. Part 2, the Human Factors Engineering Data Guide for Evaluation (HEDGE) provides planning guidance concerning what to test and includes guidance in the selection of applicable test functions, test conditions, performance tasks, and detailed design criteria. GRA

N78-24801# Essex Corp., Alexandria, Va.
HUMAN FACTORS ENGINEERING. PART 2: HEDGE Final Report
James C. Perkins, George C. Maxey, Thomas B. Malone, Sheldon W. Shenk, and Mark Kirkpatrick, III 20 Dec. 1977 134 p
(Contract DAAD05-76-C-0787)
(AD-A051482; TECOM-TOP-1-2-610-Pt-2) Avail: NTIS HC A07/MF A01 CSCL 05/5

Partial contents: How to Use HEDGE (Human Factors Engineering Data Guide for Evaluation); Operability--Vehicles; Weapons; Materiel handlers; Electronics/Signals; Operational support; and Troop support equipment; Maintainability--Vehicles; Weapons; Materiel handlers; Electronics/Signals; and Operational Support; Transportability; Portability/Usability; Erectability; and Habitability. GRA

N78-24802# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
PIVIB: A COMPUTER PROGRAM FOR ANALYSIS OF PILOT BIODYNAMIC AND TRACKING RESPONSE TO VIBRATION
Jeffrey E. Berliner and William E. Levison Sep. 1977 93 p refs
(Contract F33615-76-C-5015; AF Proj. 7231)
(AD-A052361; BBN-3457; AMRL-TR-77-72) Avail: NTIS HC A05/MF A01 CSCL 05/8

PIVIP (Pilot Response to Vibration) is a digital computer program that predicts both the biodynamic response of a pilot, and the resultant tracking behavior in a single-axis and multiple-axis whole-body vibration environments. The program is written in FORTRAN-IV-EXTENDED computer programming language and is designed for efficient batch operation on a Control Data CDC-6600 computer. The purpose of this report is to acquaint the user with the program and how to operate it. Author (GRA)

N78-24803# Army Research Inst. of Environmental Medicine, Natick, Mass. Military Ergonomics Div.
THE ROLE OF CLOTHING IN ACHIEVING ACCEPTABILITY OF ENVIRONMENTAL TEMPERATURES BETWEEN 65 F AND 85 F (18 C AND 30 C)
Ralph F. Goldman Feb. 1978 22 p refs
(DA Proj. 3E7-62777-A-845)
(AD-A052563; USARIEM-M-13/78) Avail: NTIS HC A02/MF A01 CSCL 15/5

It seems clear that the trend, since the 1920's, to lighter weight and less clothing will have to be reversed completely in the winter if thermal comfort is to be achieved at the present Federal Energy Agency guidelines of 68 to 70 F for winter thermostat settings, and because of the problem of the hands thermal comfort may not be achievable to allow for sedentary office work at temperatures below that level. The present summertime guidelines of 78 to 80 F can be achieved with

conventional summer clothing, and even the proposed extended guidelines of 80 to 82 F could be made thermally comfortable if bathing suits become acceptable as office wear. GRA

N78-24804# Navy Experimental Diving Unit, Panama City, Fla.
A COMPARISON OF THE RELATIVE MERITS OF BARALYME AND SODASORB
James R. Middleton 14 Feb. 1978 21 p
(AD-A052559; NEDU-1-78) Avail: NTIS HC A02/MF A01 CSCL 06/11

As a result of an NEDU study into the relative merits of Baralyme, manufactured by Chemetron Corp., and Sodasorb, manufactured by W.R. Grace Co., it is recommended that Type A and High Performance grades of Sodasorb be approved for use as CO2 absorbents in all Navy diving equipment. GRA

N78-24805# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
REQUIREMENTS FOR GOGGLES USED IN TRAINING TO FLY INSTRUMENTS
J. J. Vos 1977 8 p refs In DUTCH; ENGLISH summary
(Contract A75/KM/127)
(IZF-1977-4; TDCK-69057) Avail: NTIS HC A02/MF A01

The principle of the common blue and amber method of training to fly instruments is that, by complementary transmittance of the amber screens and the blue glasses the view outside is impeded while instrument reading remains possible. As it appears impossible to obtain a virtually zero transmittance that way, the question comes up which value can be considered acceptable. The upper limit appears to be appr. 0.00001 and this limit is determined by the fact that below it the still penetrating light is sufficiently masked by the reflected ambient light against the cabin windows. An absolute condition is that the amber screens only partly cover the cabin windows. Author (ESA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N78-24806 State Univ. of New York, Buffalo.
RASTER PROCESSING OF SPATIAL DATA IN GEOGRAPHIC INFORMATION SYSTEMS Ph.D. Thesis
Donna Jean Peuquet 1977 142 p
Avail: Univ. Microfilms Order No. 77-32692

A first examination of the current status of algorithms suitable for handling raster-formatted spatial data is discussed. Based on this examination, the influence of raster algorithms on the future development of efficient raster-formatted structures for spatial data and the relationships between raster and vector-formatted data within a geographic information system are discussed. It is concluded that there are raster-mode algorithms in existence which can perform many of the tasks needed for a GIS. Algorithms needed to perform initial data entry and cleaning were implemented, primarily as portions of existing image processing systems. Algorithms needed to perform tasks required for other phases of a GIS were also incorporated into existing systems handling spatial data, implemented individual as special-purpose programs. This indicates that a complete GIS based solely on raster-formatted spatial data is a theoretical possibility. Dissert. Abstr.

N78-24807*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ESCORT: A DATA ACQUISITION AND DISPLAY SYSTEM TO SUPPORT RESEARCH TESTING
Robert L. Miller 1978 10 p Presented at Electro 1978, Boston, 23-25 May 1978; sponsored by IEEE
(NASA-TM-78909; E-9644) Avail: NTIS HC A02/MF A01 CSCL 09B

Primarily designed to acquire data at steady state test conditions, the system can also monitor slow transients such as those generated in moving to a new test condition. The system configuration makes use of a microcomputer at the test site which acts as a communications multiplexer between the measurement and display devices and a centrally located minicomputer. A variety of measurement and display devices are supported using a modular approach. This allows each system to be configured with the proper combination of devices to meet the specific test requirements, while still leaving the option to add special interfaces when needed. Centralization of the minicomputer improves utilization through sharing. The creation of a pool of minis to provide data acquisition and display services to a variable number of running tests also offers other important advantages. Author

N78-24808*# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
NUMERICAL CALCULATION OF TRANSONIC FLOW PAST A SWEPT WING BY A FINITE VOLUME METHOD
Antony Jameson Dec. 1977 25 p refs Presented at the 3d IFIP Conf. on Computing Methods in Appl. Sci. and Eng., Versailles, France, 1973
(Grants NGR-33-016-167; NGR-33-016-201; Contracts N00014-77-C-0032; EY-76-C-02-3077)
(NASA-CR-157012) Avail: NTIS HC A02/MF A01 CSCL 09B

The utility of numerical methods for predicting transonic flows over wings and bodies is well established. The computer program FLO22, based on a method presented earlier, has actually been widely used to calculate the aerodynamic performance of wings of transport aircraft. Provided that a correction is made for the displacement effect of the viscous boundary layer, this code has been found to give predictions which are accurate enough to serve as a useful design guide. The main disadvantages of the scheme used in FLO22 are the use of nonconservative difference formulas, which result in a failure to satisfy conservation of mass across shock waves, and the difficulty of finding suitable transformations of coordinates to permit the treatment of more complex geometric configurations. The method described here is an attempt to overcome these shortcomings, while retaining the successful features of the previous method. The basic idea is to use a discrete approximation which directly represents a balance of the mass flow through small volume elements. This leads to a relatively simple treatment of the potential flow equation in conservation form. Author

N78-24809# Massachusetts Inst. of Tech., Cambridge.
FRAME-BASED TEXT PROCESSING
Steven T. Rosenberg 1977 35 p refs
(Contract N00014-75-C-0643)
(AD-A052444; AI-M-431) Avail: NTIS HC A03/MF A01 CSCL 05/2

This paper presents an overview of a theory of discourse structure, and discusses a model for assimilating text into a frame-based data structure. The model is being implemented in a Frame Representation Language (Goldstein and Roberts 1977). The theory assumes sentences contain links to the database which are relatively easy to compute. These links point to prior

themes which contain expectations and procedural knowledge. This knowledge is used to assimilate new sentences to these themes. At any given time, only procedural knowledge from the indicated theme is active in processing new sentences.
Author (GRA)

N78-24810# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
ACTORS AND CONTINUOUS FUNCTIONALS
Carl E. Hewitt and Henry Baker, Jr. Dec. 1977 35 p refs
(Contract N00014-75-C-0522)
(AD-A052266; MIT/LCS/TR-194) Avail: NTIS
HC A03/MF A01 CSCL 09/2

This paper presents precise versions of some 'laws' that must be satisfied by computations involving communicating parallel processes. The laws take the form of stating plausible restrictions on the histories of computations that are physically realizable. The laws are very general in that they are obeyed by parallel processes executing on a time varying number of distributed physical processors. For example, some of the processors might be in orbiting satellites. The laws are justified by appeal to physical intuition and are to be regarded as falsifiable assertions about the kinds of computations that occur in nature rather than as proved theorems in mathematics. The laws are intended to be used to analyze the mechanisms by which multiple processes can communicate to work effectively together to solve difficult problems. The laws presented in this paper are intended to be applied to the design and analysis of systems consisting of large numbers of physical processors. The development of such systems is becoming economical because of rapid progress in the development of large scale integrated circuits. We generalize the usual notion of the history of a computation as a sequence of events to the notion of a partial order of events. Partial orders of events seem better suited to expressing the causality involved in parallel computations than totally ordered sequences of events obtained by 'considering all shuffles' of the elementary steps of the various parallel processes. The utility of partial orders is demonstrated by using them to express our laws for distributed computation. These laws in turn can be used to prove the usual induction rules for proving properties of procedures. GRA

N78-24811# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
A COMPUTER ARCHITECTURE FOR DATA-FLOW COMPUTATION M.S. Thesis
David P. Misunas Mar. 1978 111 p refs
(Contract N00014-70-A-0362-0006; Proj. MAC)
(AD-A052538; MIT-LCS-TM-100) Avail: NTIS
HC A06/MF A01 CSCL 09/2

The structure of a computer which utilizes a data-flow program representation as its base language is described. The use of the data-flow representation allows full exploitation by the processor of the parallelism and concurrency achievable through the data-flow form. The unique architecture of the processor avoids the usual problems of processor switching and memory/processor interconnection by the use of interconnection networks which have a great deal of inherent parallelism. The structure of the processor allows a large number of instructions to be active simultaneously. These active instructions pass through the interconnection networks concurrently and form streams of instructions for the pipelined functional units. Due to the cyclic nature of an iterative computation, the possibility of deadlock can arise in the performance of such a computation within the dataflow architecture. A deadlock is caused by the interaction of several simultaneously active cycles of the same iterative computation. The use of a recursive rather than iterative representation of a computation avoids the deadlock problem and provides a more efficient implementation of the computation within the architecture. For this reason, a program executed by the data-flow processor is restricted to an acyclic directed graph representation. Author (GRA)

N78-24812# Utah Univ., Salt Lake City. Dept. of Computer Science.
THE APPLICATION OF TOTAL POSITIVITY TO COMPUTER AIDED CURVE AND SURFACE DESIGN
J. M. Lane and R. F. Riesenfeld Jul. 1977 98 p refs
(Contract N00014-77-C-0157; Grant NSF MCS-74-13017-A01)
(AD-A052656) Avail: NTIS HC A05/MF A01 CSCL 09/2

Of particular importance in an interactive curve and surface design system is the interface to the user. The mathematical model employed in the system must be sufficiently flexible for interaction between designer and machine to converge to a satisfactory result. The mathematical theory of Total Positivity is combined with the interactive techniques of Bezier and Riesenfeld in developing new methods of shape representation which retain the valuable variation-diminishing and convex hull properties of Bernstein and B-spline approximation, while providing improvements in the interactive interface to the user. Specifically, extending the Bezier notion of using a polygon to describe a smooth curve, methods of assigning a weight to each vertex which will control the amount of local fit to the polygon of polygonal net are provided. Thus, the designer can cause cusps and flats easily by manipulating the tension at each vertex. Further, the generalization from curves to surfaces can be done with rectilinear data or triangular data. Illustrations are provided from an experimental implementation of the newly constructed models as a demonstration of their feasibility and utility in computer aided curve and surface design. Author (GRA)

N78-24813# Southern Methodist Univ., Dallas, Tex. Dept. of Operations Research and Engineering Management.
REJECTION USING PIECE-WISE LINEAR MAJORIZING FUNCTIONS IN RANDOM VARIATE GENERATION
Bruce W. Schmeiser and Mohamed A. Shalaby Jan. 1978 16 p refs Presented at 11th Ann. Symp. on the Interface: Computer Sci. and Statistics, Raleigh, N. C., 6-7 Mar. 1978
(Contract N00014-77-C-0425)
(AD-A052570; OREM-78002) Avail: NTIS HC A02/MF A01 CSCL 09/2

In the context of random variate generation on digital computers, the use of piece-wise linear majorizing functions in conjunction with the general rejection algorithm is proposed. Based on previous results obtained in the generation of beta variates, the expected advantages and disadvantages of applying the concept to other distributions are discussed, as is the use of minorizing functions for fast acceptance of values. Areas of potential application are also discussed. Author (GRA)

N78-24814# Rome Air Development Center, Griffiss AFB, N.Y.
AN ASSOCIATIVE PROCESSOR STUDY, THE RADCAP PROJECT Technical Report, 1 Sep. 1972 - 30 Nov. 1976
Edward C. Stanke, II Feb. 1978 27 p refs
(AD-A052717; RADC-TR-77-366) Avail: NTIS
HC A03/MF A01 CSCL 09/2

The underlying objective of the Rome Air Development Center Associative Processor (RADCAP) Project is to investigate solutions to data processing problems which strain conventional approaches due to high data rates and heavy processing requirements. One group of data processing functions, those inherent in the USAF Airborne Warning and Control System (AWACS, now called the E-3A), have been chosen as being representative of this class of problems. This report describes the results of a five-year project which involved the implementation of the AWACS functions on the RADCAP testbed system which consists of a STARAN S-1000P associative processor interfaced to a Honeywell Information Systems 645-MULTICS computer (later upgraded to a HIS 6180). Based on these results, the key characteristics of an associative processor to handle this type of problem are identified and some general conclusions as to the applicability of associative/parallel processing to real-world, real-time processing problems are drawn. The report also makes some general statements concerning the future of associative/parallel processing. Author (GRA)

N78-24815# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Computer Science.
A COMMUNICATION SYSTEM FOR REMOTE PROCESSOR CONTROL
Paula Rochelle Bernstein Aug. 1977 34 p
(Contract EY-76-S-02-2383)
(COO-2383-0040; UIUDCS-F-77-888) Avail: NTIS
HC A03/MF A01

The design, development, and implementation of a system

utilizing a communications link between two computers, the PDP 11/35 and the Interdata 7/32, is presented. ERA

N78-24816 National Technical Information Service, Springfield, Va.
SEMICONDUCTOR COMPUTER STORAGE. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978
William E. Reed Mar. 1978 252 p Supersedes NTIS/PS-77/0213; NTIS/PS-76/0234; NTIS/PS-75/274
(NTIS/PS-78/0213/5; NTIS/PS-77/0213; NTIS/PS-76/0234; NTIS/PS-75/274) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

The bibliography presents Federally-sponsored research on practical operation, testing systems, fabrication, and design of semiconductor computer storage devices. Trends and forecasts are also presented for semiconductor technology in computer storage systems. GRA

N78-24173*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A HIGH-SPEED COMPUTER LINK FOR MODERATE DISTANCES AND NOISY ENVIRONMENTS
M. W. Sievers *In its* The Deep Space Network 15 Dec. 1977 p 95-99 (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

N78-24189*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN COMMAND SYSTEM MARK III-78
W. G. Stinnett *In its* The Deep Space Network 15 Feb. 1978 p 4-8 (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 09B

N78-24198*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THREE-CHANNEL INTEGRATING ANALOG-TO-DIGITAL CONVERTER
G. L. Stevens *In its* The Deep Space Network 15 Feb. 1978 p 99-104 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N78-24817# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
IMAGE PROCESSING ON THE VERSATEC PLOTTER
W. DeBoer Jun. 1977 35 p
(CSIR-SR-WISK-261; ISBN-0-7988-1140-4) Avail: NTIS HC A03/MF A01

A computer program EIMAGE was developed for processing images on the Versatec plotter. The input is assumed to be a matrix of picture elements with a variable number of rows and columns, the value of each element determining the grey value on the image. The size of the image and other options can be specified on an input card. For the sake of efficiency, the output binary matrix is not immediately stored on a magnetic tape, but on a disk file. A simple input-output program performs the copying task, after which the magnetic tape can be mounted onto the Versatec for the actual plotting. Author

N78-24818*# National Aeronautics and Space Administration, Washington, D. C.
STRUCTURED PROGRAMMING: PRINCIPLES, NOTATION, PROCEDURE
Jost May 1978 20 p ref Transl. into ENGLISH of "Strukturierte Programmierung: Prinzip, Notation, Vorgehensweisse", Rept 209 GF/J/Nou Siemens Aktiengesellschaft, West Germany, 22 Nov. 1974 23 p Transl. by SCITRAN, Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75322) Avail: NTIS HC A02/MF A01 CSCL 09B

Structured programs are best represented using a notation which gives a clear representation of the block encapsulation. In this report, a set of symbols which can be used until binding directives are republished is suggested. Structured programming also allows a new method of procedure for design and testing. Programs can be designed top down, that is, they can start at the highest program plane and can penetrate to the lowest plane by step-wise refinements. The testing methodology also is adapted to this procedure. First, the highest program plane is tested, and the programs which are not yet finished in the next lower plane are represented by so-called dummies. They are gradually replaced by the real programs. Author

N78-24819# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
AUTOMATIC DRAWING OF DIAGRAMS Ph.D. Thesis [AUTOMATISCHES ZEIHNEN VON DIAGRAMMEN]
Karl Josef Bucher 1977 135 p refs In GERMAN; ENGLISH summary
(Diss-5959) Avail: NTIS HC A07/MF A01

Several techniques for automatic drawing of a wide class of diagrams are presented and evaluated. The line drawings that can be processed are recursively structured: subdiagrams consist of several vertically connected parallel sections. Each section consists of subdiagrams and atoms that are horizontally connected. Connections need not be visible in the drawing. Atoms are arbitrary figures and may contain text. Syntax diagrams are an example of the above class. The diagram graphs are generated by a graph rewriting system controlled by a sequential notation. The two dimensional coordinate assignment problem is separated into two different one dimensional problems. Algorithms for solving these problems and a language for describing the input and output of each specific plotter program are presented. Author

N78-24820# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
THE USE OF RELATIONAL THEORY AS A DESIGN TOOL
M. C. F. King Jul. 1977 39 p refs
(CSIR-SR-WISK-262; ISBN-0-7988-1162-5) Avail: NTIS HC A03/MF A01

The application of relational data base concepts in the design of systems implemented in currently available technology is described. The importance of a 3NF network view as the basis for design is emphasized. Author

N78-24821# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
ALGORITHMS FOR SOLVING SCALAR AND BLOCK-CYCLIC TRIDIAGONAL SYSTEMS OF LINEAR ALGEBRAIC EQUATIONS
I. M. Navon Jul. 1977 49 p refs
(CSIR-SR-WISK-265; ISBN-0-7988-1156-0) Avail: NTIS HC A03/MF A01

Several algorithms are presented for solving the system $Ax = b$, where A is a diagonally dominant scaler cyclic tridiagonal matrix. Two of the algorithms are generalized for the block-cyclic tridiagonal case, and conditions for ensuring their numerical stability are discussed. With a view to a finite-difference solution, by the ADI method, of the shallow-water equations over a domain with periodic boundary conditions, two computer programs are presented for solving both scaler and block-cyclic tridiagonal systems. Author

N78-24822*# Pacifica Technology, Del Mar, Calif.
EVALUATION OF OUT-OF-CORE COMPUTER PROGRAMS FOR THE SOLUTION OF SYMMETRIC BANDED LINEAR EQUATIONS
Robert S. Dunham Dec. 1976 71 p refs
(Contract NAS8-31566)
(NASA-CR-150708) Avail: NTIS HC A04/MF A01 CSCL 09B

FORTRAN coded out-of-core equation solvers that solve using direct methods symmetric banded systems of simultaneous algebraic equations. Banded, frontal and column (skyline) solvers were studied as well as solvers that can partition the working area and thus could fit into any available core. Comparison timings are presented for several typical two dimensional and three dimensional continuum type grids of elements with and without midside nodes. Extensive conclusions are also given. Author

N78-24823# Mitre Corp., Bedford, Mass.
PROGRAM DESIGN LANGUAGES: AN INTRODUCTION
Lorna L. Cheng Jan. 1978 126 p refs
(Contract F19628-77-C-0001)
(AD-A051672; MTR-3446; ESD-TR-77-324) Avail: NTIS HC A07/MF A01 CSCL 09/2

This report is an introduction to program design languages (PDLs). A definition is given, and general functions of PDLs are discussed. A set of characteristics is defined to (1) indicate types of design information representable in PDLs and (2) to provide a framework for comparing various PDLs. Each PDL reviewed in a brief survey is discussed within the framework of these characteristics. The set of characteristics set forth when expanded, curtailed, or amended according to special needs may constitute the specification for a PDL desirable for a particular class of application. Author (GRA)

N78-24824# Stanford Univ., Calif. Electronics Labs.
THE STRUCTURE OF DIRECTLY EXECUTED LANGUAGES: A NEW THEORY OF INTERPRETIVE SYSTEM DESIGN
Lee W. Hoevel and Michael J. Flynn Mar. 1977 92 p refs
(Contract EY-76-S-03-0326; Grant DAAG29-76-G-0001)
(AD-A051702; SU-SEL-77-048; DSL-TR-130;
ARO-12958.2-M) Avail: NTIS HC A05/MF A01 CSCL 09/2

This paper concerns two important issues in the design of optimal languages for direct execution in an interpretive system: binding the operand identifiers in an executable instruction unit to the arguments of the routine implementing the operator defined by that instruction; and binding operand identifiers to execution variables. These issues are central to the performance of a system, both in space and time. GRA

N78-24825# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
COMPUTATIONAL SOLUTIONS TO A NON-UNIFORM TIME-DELAY LINEAR SYSTEM Interim Report
W. M. Chan, N. E. Nahi, and J. M. Mendel 1977 11 p ref
Presented at Symp. on Appl. of Computer Methods in Eng., Los Angeles, 23-26 Aug. 1977
(Contracts F44620-71-C-0067; Grants AF-AFOSR-2797-75; NSF ENG-75-03423; NSF ENG-74-02297)
(AD-A051060; AFOSR-78-0201TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

Two computational methods are considered for a class of non-uniform, continuous, multiple time-delay linear systems, which have been developed in the modeling of lossless layered media. The first approach discretizes the time axis and inserts states of intermediate delays, to arrive at a set of standard finite-difference equations. For our particular system, matrix multiplications can be reduced to simple scalar multiplications. The second approach defines mapping rules for the transformation of states at an interface, and keeps a state reference table for look-up and branching. The procedure is similar to ray-tracing. Several experimental results are presented to show the trade-off between storage requirement and CPU time-spent for the two methods. GRA

N78-24826# Federal Electric Corp., Vandenberg AFB, Calif.
COMPUTATION OF STATE VECTOR AND TRANSITION MATRIX FOR TRAM Final Report, 21 Mar. 1976 - 1 Jun. 1977
Gene T. Tompson 1 Jun. 1977 75 p refs
(Contract F04701-72-C-0203)
(AD-A051659; PA100-77-18; SAMTEC-TR-77-223) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report contains the analysis and documentation of subroutines which contain the capability to efficiently compute the state vector and transition matrix needed for the Kalman Filter in TRAM, a post flight estimation program. The analysis contains the development and testing of algorithms to numerically integrate, perform numerical partial differentiation and interpolate using Spline polynomials. The subroutines, which are documented in this report, use these algorithms to compute the state vector and transition matrix for the Kalman Filter. This capability has more general use than for TRAM. Author (GRA)

N78-24827# Raytheon Co., Bedford, Mass. Bedford Labs.
SOFTWARE SYSTEMS RELIABILITY: A RAYTHEON PROJECT HISTORY Final Technical Report, Feb. - Nov. 1976
H. E. Willman, Jr., T. A. James, A. A. Beaureguard, and P. Hilcoff Jun. 1977 92 p refs
(Contract F30602-76-C-0140)
(AD-A040992; BR9568; RADC-TR-77-188) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report presents results of a project to collect software data from the records of development of large Department of Defense ground-based system. A description of the subject systems software development process, characteristics, tools, and test methods are presented. Qualitative and quantitative data gathered from configuration management files are included as well as statistical summaries of this data. A detailed description of the data base files is included as well as portions of the actual data base. Recommendations are made for the use of the data as well as for the future collection of such data. The data consists of three files, VIZ 1 Module Description File 109 entries 2 Software Problem Report File 2165 entries and 3 Error Category File 193 entries. Each problem report was assigned an error category from the fault taxonomy and the data was cross correlated and summarized. The most frequent problems were in the categories of A User Requested Changes 35, B Data Handling 19%, and C Logic 18%. GRA

N78-24828# Federal COBOL Compiler Testing Service, Washington, D. C.
BIBLIOGRAPHY OF CONVERSION REFERENCES
Paul Oliver 16 Mar. 1978 7 p
(AD-A052462; FCCTS/TR-78/01) Avail: NTIS HC A02/MF A01 CSCL 09/2

This bibliography of software conversions references was compiled to be used by the Federal COBOL Compiler Testing Service in its implementation of a Federal Conversion Support Center. It includes items which deal with portability as well as conversion, reflecting the compiler's belief that problem avoidance (developing portable software) is at least as important as problem solution (conversion), and that the two issues are closely related. Author (GRA)

N78-24829# Southern Methodist Univ., Dallas, Tex. Dept. of Operations Research and Engineering Management.
A SPECIAL QUADRATIC PROGRAM Interim Report
R. Helgason, J. Kennington, and H. Lall Feb. 1978 15 p refs
(Grant AF-AFOSR-3151-77; AF Proj. 2304)
(AD-A052370; OREM-78004; AFOSR-78-0681TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper presents a characterization of the solutions of a special quadratic program. This characterization is then used in the development of an efficient algorithm for this class of problems. Author (GRA)

N78-24830# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
ABSTRACT DATA TYPES IN STACK BASED LANGUAGES M.S. Thesis
John Eliot Blakeslee Moss Feb. 1978 158 p refs Sponsored by NSF
(Contract N00014-75-C-0661)
(AD-A052332; MIT/LCS/TR-190) Avail: NTIS HC A08/MF A01 CSCL 09/2

Abstract data types are the basis of an emerging methodology of computer programming. The only existing languages supporting abstract data types directly, CLU and Simula, both require compacting garbage collection, and thus they are not suitable for many applications. This thesis presents the design of a new language incorporating abstract data types; the language requires only a run-time stack, and not garbage collection. This new language, called ASBAL(for 'A Stack Based Abstraction Language'), is based on CLU, and borrows as many features as possible directly from it. Virtually every significant feature of CLU is carried over into ASBAL in some form, and extensions are included when necessary. For example, the maximum size of objects becomes an issue and is resolved by the addition of size parameters to types. Also, a limited facility for dynamic storage allocation is incorporated in ASBAL to compensate for the removal of a garbage collected heap. This facility allows list and graph structures to be built within the framework of the

stack while preventing dangling references as a 'side-effect' of compile-time type checking. Author (GRA)

N78-24831# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Automatic Data Processing Center.
LIST OF COMPUTER PROGRAMS FOR COMPUTER-AIDED STRUCTURAL ENGINEERING Final Report
N. Radhakrishnan, Deborah Kaufman, William A. Price, and Dorothy B. May Feb. 1978 121 p
(AD-A052789; WES-TR-K-78-1) Avail: NTIS HC A06/MF A01 CSCL 13/13

This report contains a list of structural engineering and structures-related computer programs that are available with the U.S. Army Corps of Engineers. The list is arranged by structure-types and contains the computer program name, the author/contract person and office, library (if applicable), program number, computer and mode, information as to whether the program is documented or not, and a short description of the main objective of the program. Twenty-two structure groupings are provided and programs that fall in more than one subject category have been listed in all appropriate categories. Author (GRA)

N78-24832# Polytechnic Inst. of New York, Brooklyn. Dept. of Electrical Engineering and Electrophysics.
SOFTWARE MODELING STUDIES. VOLUME 1: SUMMARY OF TECHNICAL PROGRESS Final Technical Report, 1 Apr. 1974 - 1 Oct. 1977
Martin L. Shooman and Henry Ruston Griffiss AFB, N. Y. RADC Jan. 1978 50 p refs
(Contract F30602-74-C-0294)
(AD-A052615; POLY-EE77-042-Vol-1; SRS-1-12-Vol-1; RADC-TR-78-4-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report documents research performed under RADC contract by Polytechnic Institute of New York in the area of software modeling. Research in the areas of software error, reliability, and availability models (such as Markov availability models, bug tagging estimates of initial error counts and error models incorporating error generation), test models and techniques (such as determination of the number of the tests necessary to execute all program paths and statistical test models), and complexity models (such as component measures like testedness and natural language theory measures) that was described in previous progress and technical reports is summarized and unfinished research (in areas such as acceptance test models and automatic programming techniques) not previously reported is described. The significant results are highlighted along with their interrelations and potential. GRA

N78-24833# TRW Defense and Space Systems Group, Redondo Beach, Calif.
AUTOMATED COMPILER TEST CASE GENERATION Final Technical Report, Apr. 1976 - Dec. 1977
Paul T. Berning, Eric R. Anderson, and Frank C. Belz Feb. 1978 111 p refs
(Contract F30602-76-C-0255)
(AD-A052726; RADC-TR-78-30) Avail: NTIS HC A06/MF A01 CSCL 09/2

This report discusses the overall design of a software tool for the automation of validation of compilers for conformance to the specification of the high-order programming language they process. Such compiler validation is currently tedious, time-consuming, error-prone, and not completely effective. The generation of test cases for compiler validation is here envisioned as a two-step process. The starting point for this implementation is the SEMANOL tool, which consists of a machine-representable exact specification of a high-order language that is used to check the consistency of the HOL specification and to directly execute programs written in that HOL. SEMANOL is used by the Analyzer to generate constraints to which compiler test cases must adhere. The Synthesizer then uses these constraints to generate the test cases via a tree-building process. Although a considerable degree of human intervention is still required in the development of compiler test programs when a tool such as the one designed under this effort is employed, a vast improvement in the process of compiler validation and verification is expected to result. GRA

N78-24834# System Development Corp., Santa Monica, Calif.
SOFTWARE ACQUISITION MANAGEMENT GUIDEBOOK: REVIEWS AND AUDITS
George Neil Nov. 1977 82 p
(Contract F19628-76-C-0236)
(AD-A052567; SDC-TM-5772/006/02; ESD-TR-78-117) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report is one of a series of Software Acquisition Management Guidebooks which provide information and guidance for ESD Program Office personnel who are charged with planning and managing the acquisition of command, control, and communications system software procured under Air Force 800 series regulations and related software acquisition management concepts. It combines existing guidance regarding reviews and audits currently contained in a number of different official documents into a single document and narrows the focus of existing guidance to those problems inherent in software acquisition management. Where appropriate, existing guidance is extended to include practices and procedures based on the practical experience of the author and others in acquiring software. The objective of this document is to instruct Air Force Program Office personnel in the effective use of reviews and audits as management tools in acquiring software. Author (GRA)

N78-24835*# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
DATA REPRESENTATIONS IN PDP-10 MACLISP
Guy Lewis Steele, Jr. Sep. 1977 14 p refs Presented at MACSYMA Users Conf., Berkeley, Calif, Jul. 1977
(Grant NsG-1323; Contracts N00014-75-C-0643; E(11-1)-3070)
(NASA-CR-157163; AD-A052305; AI-M-420) Avail: NTIS HC A02/MF A01 CSCL 09/2

The internal representations of the various MacLISP data types are presented and discussed. Certain implementation tradeoffs are considered. The ultimate decisions on these tradeoffs are discussed in the light of implementation of large systems such as MACSYMA. The basic strategy of garbage collection is outlined, with reference to the specific representations involved. Certain 'clever tricks' are explained and justified. The 'address space crunch' is explained and some alternative solutions explored. Author (GRA)

N78-24836# Arinc Research Corp., Santa Ana, Calif.
DEVELOPMENT OF ON-LINE SOFTWARE PACKAGE FOR CALCULATING ACQUISITION COSTS Technical Report, Mar. - Apr. 1977
P. J. Orth Apr. 1977 21 p
(Contract F33657-77-D-0029)
(AD-A052714; W77-1974-TN01) Avail: NTIS HC A02/MF A01 CSCL 05/1

ARINC Research assisted the ALCM Program Office by developing an on-line computer program that allows a large spectrum of potential users, including those not familiar with computer programming, to calculate acquisition costs for a wide range of scenarios. The program provides outputs in a generalized format as specified by each user. Users have available a large selection of routines that can be called into operation as needed, and which will operate on input data as specified by the user. The program is now operational at the computer facility at Wright-Patterson Air Force Base, Dayton, Ohio. GRA

N78-24837# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
PROGRAMMING VIEWED AS AN ENGINEERING ACTIVITY
Charles Rich, Howard E. Shrobe, Richard C. Waters, Gerald J. Sussman, and Carl E. Hewitt Jan. 1978 54 p refs
(Contract N00014-75-C-0643)
(AD-A052307; AI-M-459) Avail: NTIS HC A04/MF A01 CSCL 09/2

It is profitable to view the process of writing programs as an engineering activity. A program is a deliberately contrived mechanism constructed from parts whose behaviors are combined to produce the behavior of the whole. One proposes to develop a notion of understanding a program which is analogous to similar notions in other engineering subjects. Understanding is a rich notion in engineering domains. It includes the ability to

identify the parts of a mechanism and assign a purpose to each part. Understanding also entails being able to explain to someone how a mechanism works and rationalize its behavior under unusual circumstances. Part of the methodology for investigating these ideas is to build a computer-aided design tool for computer programs. The construction of this tool will serve both as a concrete realization of the theoretical ideas and as a testbed for our practical techniques. GRA

N78-24838# Environmental Protection Agency, Research Triangle Park, N.C. Industrial Environmental Research Lab.
SR-52 PROGRAMMABLE CALCULATOR PROGRAMS FOR VENTURI SCRUBBERS AND ELECTROSTATIC PRECIPITATORS Final Report, 6-8 Jun. 1977
Leslie E. Sparks Mar. 1978 78 p refs
(PB-277672; EPA-600/7-78-026) Avail: NTIS HC A05/MF A01 CSCL 09B

Tools for estimating particulate removal by venturi scrubbers and electrostatic precipitators are presented. Detailed descriptions are given for programs to predict the penetration (one minus efficiency) for each device. These programs were written specifically for the Texas Instruments SR-52 programmable calculator. Each program included a general description of the mathematical model on which the program was based and the formulas and numerical techniques used in adapting the model to the SR-52. Numerical examples, program listing, and user instructions were included. GRA

N78-24186*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COST EVALUATION OF A DSN HIGH LEVEL REAL-TIME LANGUAGE
M. McKenzie *In its* The Deep Space Network 15 Dec. 1977 p 214-225 (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

N78-24204*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRANSFORM DECODING OF REED-SOLOMON CODES OVER GF(2 TO THE 2n POWER USING THE TECHNIQUES OF WINOGRAD
I. S. Reed (Univ. of Southern Calif., Los Angeles), T. K. Truong, and B. Benjauthrit *In its* The Deep Space Network 15 Feb. 1978 p 141-163 refs (For availability see N78-24187 15-12)
(Grant AF-AFOSR-2798-75)
Avail: NTIS HC A12/FM A01 CSCL 09B

N78-24211*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN SYSTEM PERFORMANCE TEST SOFTWARE
M. Martin *In its* The Deep Space Network 15 Feb. 1978 p 224-251 (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 09B

N78-24226*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A PUBLIC-KEY CRYPTOSYSTEM BASED ON ALGEBRAIC CODING THEORY
R. J. McEliece *In its* The Deep Space Network 15 Apr. 1978 p 114-116 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 09B

N78-24229*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DSN STANDARD REAL-TIME LANGUAGE
R. L. Schwartz, G. L. Fisher, and R. C. Tausworthe *In its* The Deep Space Network 15 Apr. 1978 p 131-138 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 09B

N78-24238*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPLEMENTATION OF AUTOMATED FAULT ISOLATION TEST PROGRAMS FOR MAXIMUM LIKELIHOOD CONVOLUTIONAL DECODER (MCD) MAINTENANCE
M. E. Alberda *In its* The Deep Space Network 15 Apr. 1978 p 236-244 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

N78-24839# Kansas State Univ., Manhattan. Dept. of Computer Science.
PROJECT REPORT FOR FUNCTIONALLY DISTRIBUTED COMPUTER SYSTEMS DEVELOPMENT: SOFTWARE AND SYSTEMS STRUCTURE, PART 1 Interim Report, 15 Jan. 1976 - 1 Nov. 1977
Virgil E. Wallentine Oct. 1977 75 p refs
(Grant DAAG29-76-G-0108)
(AD-A052751; ARO-13835.1-A-EL-Pt-1) Avail: NTIS HC A04/MF A01 CSCL 17/2

This is the first of a two part report of the research performed by Kansas State University in multiple processor computer systems and networks. This report covers the research effort through the design phase. The known problems are defined and alternative solutions are developed. An alternative solution is selected for the building of a prototype network. Author (GRA)

N78-24840# Kansas State Univ., Manhattan. Dept. of Computer Science.
PROJECT REPORT FOR FUNCTIONALLY DISTRIBUTED COMPUTER SYSTEMS DEVELOPMENT: SOFTWARE AND SYSTEMS STRUCTURE, PART 2 Final Report, 1 Nov. 1976 - 15 Jan. 1977
Virgil E. Wallentine 7 Feb. 1978 100 p refs
(Grant DAAG29-76-G-0108)
(AD-A052752; ARO-13835.1-A-EL-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 17/2

This is the second and final part of the report of research performed by Kansas State University in multiple processor computer systems and networks. Part 1 covered the Design Phase of the effort; and this report covers the follow-on implementation, integration, test, and demonstration of a prototype model of the network. The network model consists of a cluster of minicomputers and microcomputers with supporting software. The model has been named MIMICS (MIni-MIcroComputer System) and uses a high-speed vendor-independent data bus, named KSUBUS, that was designed, developed, and built for this network. Network hardware included Interdata's 85, 7/32, 8/32 and IBM 370/158. The principal network software is a message system which is capable of residing in a variety of computers. The hardware independence is achieved by design and by coding the software in Concurrent PASCAL. A specification of a distributed data base management system was developed and implemented in the MIMICS network. A DBMS named TOTAL was used in the prototype. The general problems of DDBMS were studied, and solution syntheses are presented as well as a simulation model for a back-end DBMS. Author (GRA)

N78-24841# Texas Univ., Austin. Electronics Research Center.
DETECTION OF STATIC AND DYNAMIC HAZARDS IN LOGIC NETS
Ajoy K. Bose and S. A. Szygenda Jun. 1977 6 p refs
(Contract F44620-76-C-0089; AF Proj. 2305)
(AD-A052616; AFOSR-78-0689TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper discusses an algorithmic procedure for the detection of static and dynamic hazards in a digital simulation environment. The procedure uses a signal representation scheme that decomposes multi-level signals to a binary form which are used along with a binary description of the network to realize hazard detection. Moreover this procedure can also be used to realize multi-level simulation and provides the user with various options about the accuracy that can be obtained at varying costs. Author (GRA)

N78-24842# SRI International Corp., Menlo Park, Calif. Network Information Center.
ARPANET PROTOCOL HANDBOOK
Elizabeth Feinler (Univ. of Southern Calif., Marina Del Rey) and Jonathan Postel Jan. 1978 509 p refs
(Contract DCA200-C-641)
(AD-A052594; AD-E100035; NIC-7104-Rev-2) Avail: NTIS HC A22/MF A01 CSCL 17/2

The ARPANET Protocol Handbook is a collection of documents that describe the protocols currently in use on the ARPANET Computer Network as of January 1978. Protocols are the rules

of communication between processes on the network. The protocols in use on the ARPANET form a tree structure. The basic protocol is the IMP-to-Host Protocol. Directly under that is the Host-to-Host Protocol. Spreading out beneath, but still closely related, are the process level protocols: TELNET, File Transfer, Remote Job Entry, and Graphics. Interspersed along the way are a few small protocols such as the Initial Connection Protocol, and the definition of the standard character set.
Author (GRA)

N78-24843# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ARPA AUTHORING-SYSTEM Semiannual Technical Summary Report, 1 Apr. - 30 Sep. 1977
William P. Harris 30 Sep. 1977 15 p refs
(Contract F19628-76-C-0002; ARPA Order 3199)
(AD-A052464; ESD-TR-77-342) Avail: NTIS HC A02/MF A01 CSCL 05/9

The work during this reporting period has concentrated on preparations for a full-scale test of the ARPA Authoring System in FY 78. A five-stage procedure has been developed for management of task-oriented lesson development in the on-the-job environment. It is consistent with the Interservice Procedures for Instructional System Development. It is readily adapted to other delivery systems with capabilities similar to the one of choice here, the Lincoln Terminal System, Model 5(LTS-5). A test of evaluation procedures on task-oriented materials prepared under the Authoring System is also reported. The plan to test the system, including preparation and evaluation of materials for both maintenance technicians and technical operators, is reviewed. Author (GRA)

N78-24844# Fondazione Ugo Bordoni, Rome (Italy).
DISTRIBUTED MICROPROCESSOR STORED PROGRAM CONTROL IN A SWITCHING NETWORK
Roberto Montemurro 1977 8 p refs Presented at the EUROCON 77 Meeting, Venice, 3-7 May 1977
(FUB-4-1977) Avail: NTIS HC A02/MF A01

A possible modular digital switching system with a microprocessor distributed control which may ease some engineering installation and administrative problems is described.
Author (ESA)

N78-25038# Joint Publications Research Service, Arlington, Va.
PRINCIPLES OF CONSTRUCTING INTERFACING DEVICES OF THE SM-3 CONTROL COMPUTER
A. Ya. Sokolov and E. V. Keshek *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 30 (JPRS-70714) 2 Mar. 1978 p 9-17 Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 11, 1977 p 9-11 (For availability see N78-25037 15-99)
Copyright. Avail: NTIS HC A05/MF A01

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N78-24845*# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.
FINITE-STATE COMPENSATORS FOR CONTINUOUS PROCESSES
T. L. Johnson 1978 7 p refs
(Grants NGL-22-009-124; AF-AFOSR-3281-77)
(NASA-CR-157062; ESL-P-812) Avail: NTIS HC A02/MF A01 CSCL 09B

Mathematical representation of feedback systems composed of both continuous and finite-state processes is discussed. Such a representation provides a new viewpoint for the design of computer control systems for industrial processes, and clarifies areas in which further research is required. Some motivating examples are provided. Author

N78-24846# Massachusetts Inst. of Tech., Cambridge.
SYSTEMS WITH MEMORY AND SYSTEMS DEFINED ON ALGEBRAIC STRUCTURES Final Report, 17 Nov. 1975 - 31 Aug. 1977
Sanjoy K. Mitter 27 Jan. 1978 21 p refs
(Contract DAAG29-76-C-0008)
(AD-A051168; ARO-12681.2-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

This research has been concerned with the development of a theory of control and observation for systems with time delays in the state, input variables. A theory, almost as complete for the non-delay situation has been constructed. The roles of stabilizability, reachability and observability concepts in this theory have been clarified. Numerical procedures for solving some of these problems have been developed. Author (GRA)

N78-24847# Rice Univ., Houston, Tex. Aero-Astronautics Group.
SEQUENTIAL CONJUGATE GRADIENT-RESTORATION ALGORITHM FOR OPTIMAL CONTROL PROBLEMS WITH NONDIFFERENTIAL CONSTRAINTS. PART 1: THEORY Interim Report
J. R. Cloutier, B. P. Mohanty, and A. Miele 1977 83 p refs
(Grant AF-AFOSR-3075-76; AF Proj. 2304)
(AD-A051102; AAR-126-Pt-1; AFOSR-78-0277TR-Pt-1) Avail: NTIS HC A05/MF A01 CSCL 12/1

A sequential conjugate gradient-restoration algorithm is developed in order to solve optimal control problems involving a functional subject to differential constraints, nondifferential constraints, and terminal constraints. The algorithm is composed of a sequence of cycles, each cycle consisting of two phases, a conjugate gradient phase and a restoration phase. The conjugate gradient phase involves a single iteration and is designed to decrease the value of the functional while satisfying the constraints to first order. The restoration phase involves one or more iterations and is designed to restore the constraints to a predetermined accuracy, while the norm of the variations of the control and the parameter is minimized, subject to the linearized constraints. The sequential conjugate gradient-restoration algorithm is characterized by two main properties. First, at the end of each cycle, the trajectory satisfies the constraints to a given accuracy. Second, the conjugate gradient stepsize and the restoration stepsize can be chosen so that the restoration phase preserves the descent property of the conjugate gradient phase. GRA

N78-24848# Utah Univ., Salt Lake City. Dept. of Computer Science.
IMAGE RECOGNITION USING GENERALIZED CORRELATION
Lee Edwin McDonald Aug. 1977 79 p refs
(Contract DAHC15-73-C-0363; ARPA Order 2477)
(AD-A051755; UTEC-CSC-77-135) Avail: NTIS HC A05/MF A01 CSCL 05/8

This paper investigates the use of generalized cross-correlation in pattern matching when the objects may be of one or two dimensions. Generalized correlation can be used to determine the amount of dilatation and rotation between a given template and an object, in addition to determining the relative translation. Two techniques are discussed which break this four-dimensional correlation into two two-dimensional correlations making the problem computationally feasible. The techniques were developed for a specific class of images, however, they can be applied to a more general class. Author (GRA)

N78-24849# Colorado Univ., Boulder. Dept. of Electrical Engineering.
FEEDBACK SYSTEM DESIGN Interim Report, 31 Oct. 1977
Issac W. Horowitz 1977 11 p refs
(Grant AF-AFOSR-2946-76; AF Proj. 2304)
(AD-A051062; AFOSR-78-0203TR) Avail: NTIS HC A02/MF A01 CSCL 13/6

Major success was achieved in the development of a quantitative synthesis theory for the class of single input-output uncertain plants consisting of two parallel branches, one of which has a finite number of cascaded internal points which can be measured and used for feedback purposes, but with no plant modification. Significant progress was made in the cascaded plant problem with plant modification permitted, and in the single loop plant with unrestricted uncertain poles and zeroes. Two

research reports were completed, and two papers were completed and submitted for publication. Author (GRA)

N78-24850# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.

APPROXIMATION TECHNIQUES FOR CONTROL SYSTEMS WITH DELAYS Interim Report

H. T. Banks and J. A. Burns (Va. Polytech. Inst. and State Univ.) Sep. 1977 22 p refs Presented at Intern. Conf. on Methods of Mathmatical Programming, Zakopane, Poland, Sep. 1977

(Grant AF-AFOSR-3092-76; AF-AFOSR-3221-77; NSF MCS-76-07247)

(AD-A051071; AFOSR-78-0199TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A theoretical framework for approximation techniques for nonlinear system optimal control problems is presented. Two particular approximation schemes that may be used in the context of this framework are discussed and typical numerical results for two examples to which we have applied these schemes are given. A brief survey of related investigations is given. GRA

N78-24851# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

THE FRL MANUAL

R. Bruce Roberts and Ira P. Goldstein Sep. 1977 30 p refs (Contract N00014-75-C-0643)

(AD-A052310; AI-M-409) Avail: NTIS HC A03/MF A01 CSCL 09/4

The Frame Representation Language (FRL) is described. FRL is an adjunct to LISP which implements several representation techniques suggested by Minsky's concept of a frame: defaults, constraints, inheritance, procedural attachment, and annotation. Author (GRA)

N78-24852# Washington Univ., Seattle. Dept. of Mathematics.

OPTIMIZATION PROBLEMS: DUALITY AND MULTIPLIER METHOD Interim Report

R. T. Rockafellar 8 Feb. 1978 8 p

(Grant AF-AFOSR-77-3204)

(AD-A052491; AFOSR-78-0393TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This describes five articles, a doctoral dissertation and part of a book manuscript produced under the grant in question in 1977. Author (GRA)

N78-24853# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

COMPUTATION OF LOCALLY PARALLEL STRUCTURE

Kent A. Stevens Mar. 1977 33 p

(Contract N00014-75-C-0643)

(AD-A052406; AI-M-392) Avail: NTIS HC A03/MF A01 CSCL 06/4

A Moire-like effect can be observed in dot patterns consisting of two superimposed copies of a random dot pattern where one copy has been expanded, translated, or rotated. One perceives in these patterns a structure that is shown by experiment to be limited by the local geometry of the pattern, independent of the overall structure or the dot density. A simple representation of locally parallel structure is proposed, and it is found to be computable by a non-iterative, parallel algorithm. An implementation of this algorithm is demonstrated. Its performance parallels that observed experimentally, providing a potential explanation for human performance. Advantages are discussed for the early description of locally parallel structure in the course of visual processing. Author (GRA)

N78-24854# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.

DESCRIPTIONS AND THE SPECIALIZATION OF CONCEPTS

William A. Martin Mar. 1978 42 p

(Contract N00014-75-C-0661)

(AD-A052773; MIT-LCS-TM-101) Avail: NTIS HC A03/MF A01 CSCL 09/2

The OWL II system computes with expressions which describe an object from a particular viewpoint. These partial descriptions form a tree structure under the specialization operation, which preserves intensional properties. The descriptions are also related in terms of their extensions by characterization and exemplar links. Descriptions of individuals must always specify a context of the description. Eight ways in which one description can be a specialization of another are distinguished. Author (GRA)

N78-24855# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

A SYSTEM FOR REPRESENTING AND USING REAL-WORLD KNOWLEDGE

Scott E. Fahlman Dec. 1977 197 p

(Contract N00014-75-C-0643)

(AD-A052748; AI-TR-450) Avail: NTIS HC A09/MF A01 CSCL 09/2

This report describes a knowledge-base system in which the information is stored in a network of small parallel processing elements--node and link units--which are controlled by an external serial computer. Discussed is NETL, a language for storing real-world information in such a network. A simulator for the parallel network system has been implemented in MACLISP, and an experimental version of NETL is running on this simulator. A number of test-case results and simulated timings will be presented. Author (GRA)

N78-24856# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

A GLIMPSE OF TRUTH MAINTENANCE

Jon Doyle Feb. 1978 16 p refs

(Contract N00014-75-C-0643)

(AD-A052308; AI-M-461) Avail: NTIS HC A02/MF A01 CSCL 06/4

Many procedurally-oriented problem solving systems can be viewed as performing a mixture of computation and deduction, with much of the computation serving to decide what deductions should be made. This results in bits and pieces of deductions being strewn throughout the program text and execution. This paper describes a problem solver subsystem called a truth maintenance system which collects and maintains these bits of deductions. Automatic functions of the truth maintenance system then use these pieces of 'proofs' to consistently update a data base of program beliefs and to perform a powerful form of backtracking called dependency-directed backtracking. Author (GRA)

N78-24857# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Electrical Engineering and Applied Physics.

THE USE OF DISTRIBUTED ASSOCIATIVE MEMORIES FOR SURMOUNTING PROBLEMS OF SCALING AND ORIENTATION IN AUTOMATED PATTERN RECOGNITION Final Report, 1 Nov. 1975 - 31 Oct. 1977

Yoh-Han Pao and W. L. Schultz 10 Mar. 1978 52 p refs (Grant DAAG29-76-G-0064)

(AD-A052341; ARO-13501.3-A-EL) Avail: NTIS HC A04/MF A01 CSCL 06/4

The area of research to which this study relates is that of pattern recognition and in particular, the automated recognition of objects irrespective of the location, orientation and magnitude of such objects in the field of view of the observer. It is shown that a recently developed associative memory technique is suitable for use in a hierarchical mode together with an automated computer video system, for detecting, tracking and subsequently recognizing an object irrespective of variations in location, size and orientation. Author (GRA)

N78-24858# Institute for Perception RVO-TNO, Soesterberg (Netherlands).

SURVEY ON ONGOING PATTERN RECOGNITION RESEARCH PROJECTS IN THE NETHERLANDS [OVERZICHT VAN LOPENDE PATROONHERKENNINGSPROJEKTEN IN NEDERLAND]

L. C. W. Pols 1977 19 p refs Partly in DUTCH and partly in ENGLISH

(IZF-1977-3; TDCK-69056) Avail: NTIS HC A02/MF A01

The projects are listed according to the RS6-4 classification scheme. This documentation has also been presented to the NATO AC/243 (Panel 3) Research Study Group (RSG) 4 on

Pattern Recognition, a group surveying pattern recognition projects in the NATO member states. ESA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N78-24859# Kentucky Univ. Lexington
NOTES ON GALERKIN, COLLOCATION AND COLLOCATION-GALERKIN METHODS FOR LINEAR TWO-POINT BOUNDARY-VALUE PROBLEMS
Graeme Fairweather Republic of South Africa, Pretoria National Research Institute for Mathematical Sciences Jul. 1977 62 p refs
(CSIR-SR-WISK-247; ISBN-0-7988-1167-6) Avail: NTIS HC A04/MF A01

Some of the basic techniques used in the derivation of global error estimates and superconvergence results are illustrated for Galerkin, collocation, and collocation-Galerkin methods for the approximate solution of linear two-point boundary value problems. Attention is devoted mainly to those techniques which can be used in the analysis of such methods for time dependent problems. Author

N78-24860*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LAGRANGIAN COMPUTATION OF INVISCID COMPRESSIBLE FLOWS
G. H. Klopfer May 1978 60 p refs
(NASA-TM-78456; A-7288) Avail: NTIS HC A04/MF A01 CSCL 12A

A Lagrangian method is developed to solve the Euler equations of gas dynamics. The solution of the equations is obtained by a numerical computation with the well-known Flux-Corrected-Transport (FCT) numerical method. This procedure is modified so that the boundary treatment is accurate and relatively simple. Shock waves and other flow discontinuities are captured monotonically without any type of fitting procedures. The Lagrangian method is employed so that the problem of mesh generation is completely avoided. The method is applicable to all Mach numbers except the low subsonic range where compressibility effects are small. The method is applied to a one-dimensional Riemann problem (shock tube) and to a two-dimensional supersonic channel flow with reflecting shock waves. Author

N78-24861# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
EXACT CALCULATION WITH REAL NUMBERS AND OTHER INFINITIVE OBJECTS Ph.D. Thesis [EXAKTES RECHNEN MIT REELLEN ZAHLEN UND ANDEREN UNENDLICHEN OBJEKTEN]
Edwin Wiedmer 1977 132 p refs In GERMAN; ENGLISH summary
(Diss-5975) Avail: NTIS HC A07/MF A01

Real numbers are the best known examples of objects represented by words of infinite length. It is shown how to actually compute with real numbers in a reliable way, using signed digit number representations. A generalization is developed to computation on arbitrary sets S by means of subjective mappings from subsets of the set of all finite and infinite words over a finite alpha A into S. The theory is illustrated by further examples: formal power series, etc. Author

N78-24862# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
NONLINEAR ELLIPTICAL AND PARABOLIC PROBLEMS IN UNBOUNDED DOMAINS Ph.D. Thesis [NICHTLINEARE ELLIPTISCHE UND PARABOLISCHE PROBLEME IN UNBESCHRAENKTEN GEBIETEN]
Guy Mahler 1977 47 p refs In GERMAN; ENGLISH summary
(Diss-6007) Avail: NTIS HC A03/MF A01

Problems in unbounded domains with sufficiently smooth boundary are considered. Elliptic problems for quasilinear operators are treated along with nonlinear variational inequalities. Weak solutions are obtained for noncoercive boundary value problems. Parabolic boundary value problems are also discussed. Author

N78-24863# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
INFORMATION CONCENTRATION OF MODELS FOR ASSERTIVE LOGIC AND THE P=NP- PROBLEM Ph.D. Thesis [INFORMATIONSVERDICHTUNG VON MODELLEN IN DER AUSSAGENLOGIK UND DAS P=NP-PROBLEM]
Karl Lieberherr 1977 150 p refs In GERMAN; ENGLISH summary
(Diss-5941) Avail: NTIS HC A07/MF A01

The problem of deciding whether a given formula of the propositional calculus is satisfiable was studied. A deduction rule, called superresolution, is introduced and compared with known proof-systems and decision procedures. Probabilistic algorithms for NP- complete languages are investigated. Author

N78-24864# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
AN APPROXIMATELY CROSSING-SYMMETRIC VERTEX FUNCTION
W. D. Heiss Jun. 1977 34 p refs
(CSIR-SR-WISK-263; ISBN-0-7988-1141-2) Avail: NTIS HC A03/MF A01

An important consistency property, the crossing symmetry, has been neglected in traditional approximation schemes for the vertex function occurring in quantum mechanical many body theory. An integral equation is proposed which treats the s- and t-channels on the same footing and thus provides for an intricate blending of the two channels. The solution of this equation is given in analytic terms, and although complicated, the form of the solution allows the physically interesting features to be investigated numerically. Author

N78-24865# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
ORDERING AND STABILITY PROPERTIES OF THE RICCATI EQUATION
M. Pachter and T. E. Bullock Jun. 1977 67 p refs
(CSIR-SR-WISK-264; ISBN-0-7988-1143-9) Avail: NTIS HC A04/MF A01

The theory of the algebraic matrix Riccati equation and the matrix Riccati differential equation is developed using simple results from Lyapunov theory. The ordering theorems given are necessary and sufficient, so that the relaxed stabilizability-type assumptions are really the minimal assumptions. The cases of an infinite number and a finite number of solutions are characterized, and a count of the number of solutions is given. These results on the algebraic Riccati equation are then brought to bear on the matrix Riccati differential equation by studying stability and regions of attraction. Affinities with the theory of the linear quadratic regulator with terminal pay-off are discussed and the paper is concluded with comments on linear quadratic differential games. Author

N78-24866# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
APPROXIMATION BY VECTOR-VALUED FUNCTIONS
M. Brannigan Jul. 1977 13 p refs
(CSIR-SR-WISK-266; ISBN-0-7988-1158-7) Avail: NTIS HC A02/MF A01

The theory of H-sets has been shown to be useful in the study of uniform approximation. The form H-sets take in this setting of vector-valued functions is considered and a general characterization theorem is proven. Author

N78-24867# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
H-SETS AND NON-LINEAR CHEBYSHEV APPROXIMATION
M. Brannigan Aug. 1977 17 p refs
(CSIR-SR-WISK-272; ISBN-0-7988-1175-7) Avail: NTIS HC A02/MF A01

The study of H-sets in linear Chebyshev approximation has proved to be crucial for the case when the Haar condition fails.

The definition of H-sets is extended to include nonlinear Chebyshev approximation and, assuming that the Frechet derivatives of the approximating functions exist, relationships are shown between H-sets so defined and H-sets in the linear space of derivatives. Proof is given for the nonlinear case general approximation theorems analogous to those for the linear case, these characterization theorems forming the basis of numerical procedures. Author

N78-24868# Georgia Inst. of Tech., Atlanta.
A COST OPTIMAL APPROACH TO SELECTING A FRACTIONAL FACTORIAL DESIGN M.S. Thesis
William Francis Friese, Jr. Jun. 1977 93 p refs Sponsored by Army
(AD-A051259) Avail: NTIS HC A05/MF A01 CSCL 12/1

This research develops a multistage decision process designed to obtain the maximum amount of information from the evaluation of a factorial design while minimizing the amount of resources used in obtaining the information. The use of screening experiments in building the factorial design is investigated in order to maximize the amount of information gained. The use of sequential analysis procedures to terminate experimentation at the earliest possible time is investigated in order to minimize the amount of resources used. The research is limited to 2 to the n power factorial designs involving univariate response models assumed to come from a normal population; however, the procedure can be easily extended to any factorial design. The approach is demonstrated for an operational test involving a 2 to the 6th power factorial design and the results are compared to classical procedures. The sensitivity of the required input parameters is investigated and related applications are discussed. The proposed approach is found to be a viable method of designing, conducting, and evaluating an operational test involving a factorial experiment. Author (GRA)

N78-24869# Texas Univ., Austin. Center for Numerical Analysis.
THE ACCELERATED SSOR METHOD FOR SOLVING LARGE LINEAR SYSTEMS
Linda J. Hayes and David M. Young May 1977 48 p refs (Grant DAHC04-74-G-019818)
(AD-A051491; ITR-CNA-123; ARO-12301.6-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

The symmetric SOR method (SSOR-method) for solving the linear system Au = b is considered. The basic properties of the SSOR method are summarized, and a procedure is given for estimating the optimum relaxation factor omega and the corresponding spectral radius of the SSOR matrix S sub omega. Two procedures for accelerating the convergence of the SSOR method are considered, one based on conjugate gradient acceleration and the second based on the use of Chebyshev acceleration. Two versions of conjugate gradient acceleration are considered--the nonadaptive and the adaptive. Author (GRA)

N78-24870# Tel-Aviv Univ. (Israel). Dept. of Mathematical Sciences.
STABILITY OF TWO DIMENSIONAL INITIAL BOUNDARY VALUE PROBLEMS USING LEAP-FROG TYPE SCHEMES Interim Report, 30 Jun. 1976 - 29 Jun. 1977
Saul S. Abarbanel and David Gottlieb 1977 25 p refs (Grant AF-AFOSR-3035-76)
(AD-A050381; AFOSR-78-0166TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The linear stability of a Leap- Frog and a Modified Leap-Frog scheme for two dimensional hyperbolic initial boundary value problems is investigated. Different stable boundary treatments are presented for each case. In one case, the boundary condition is found to further restrict the Cauchy stability condition. A 2x2 2- D system is also considered and a stable boundary treatment is presented. Author (GRA)

N78-24871# Basel Univ. (Switzerland). Mathematics Inst.
TOPICS IN THE THEORY OF ALGEBRAIC EQUATIONS Final Technical Report, Nov. 1974 - Nov. 1977
Alexander M. Ostrowski Nov. 1977 70 p refs (Grant DA-ERO-75-G-035)
(AD-A050660) Avail: NTIS HC A04/MF A01 CSCL 12/1

Contents: Applicability of the Bernoulli-L'Hospital rule was investigated, if the usual assumptions fail on a zero set; The probably most general extension of integrals of Cauchy-Frullani type was developed, which contains, beyond all special cases as yet known, a great number of further types of integrals; The classical theorem on irreducibility of the resultant of two general polynomials is extended to the case where one of these polynomials contains only one free parameter; An investigation was made of the properties of the Kronecker extensions of polynomial ideals; In discussions of the de Moivre - Laplace formula in the calculus of probabilities, it is proved that the error term is false and the correct term is determined and investigated; and Distributions of irrational numbers in a linear interval are investigated with the results extended to vectors with irrational coefficients in an m-dimensional interval in R to the mth power. GRA

N78-24872# Florida State Univ., Tallahassee. Dept. of Statistics.
TREND-FREE BLOCK DESIGNS: THEORY
Ralph A. Bradley and Ching-Ming Yen Feb. 1978 23 p refs (Contract N00014-76-C-0608)
(AD-A052317; FSU-Statistics-M453; TR-130-ONR) Avail: NTIS HC A02/MF A01 CSCL 12/2

A common polynomial trend in one or more dimensions is assumed to exist over the plots in each block of a classical experimental design. An analysis of covariance model is assumed with trend components represented through use of orthogonal polynomials. The objective is to construct new designs through the assignment of treatments to plots within blocks in such a way that sums of squares for treatments and blocks are calculated as though there were no trend and sums of squares for trend components and error are calculated easily. Such designs are called trend-free and a necessary and sufficient condition for a trend-free design is developed. It is shown that these designs satisfy optimality criteria among the class of connected designs with the same incidence matrix. The analysis of variance for trend-free designs is developed. The paper concludes with two examples of trend-free designs. Author (GRA)

N78-24873# Kansas Univ., Lawrence. Dept. of Electrical Engineering.
NUMERICAL IMPLEMENTATION METHODS FOR NONLINEAR ESTIMATORS Final Report
R. L. Klein Mar. 1978 5 p refs (Grant AF-AFOSR-2828-75; AF Proj. 2304)
(AD-A052408; AFOSR-78-0691TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Four papers were published during the ensuing period of this grant. One paper reviewed the connection between monospline functions and optimal quadrature formulae and demonstrated their application to the estimator implementation problem. Another paper showed how gauss quadratures could solve discretization problems which are inherently a part of any numerical approach. The third paper developed the theory for applying optimal quadrature formulas to the nonlinear estimation problem. Finally, the problem of obtaining the parameters for the formulas used in the optimal quadrature method was solved. For additional details refer to the work unit file. Author (GRA)

N78-24874# Istituto di Fisica Dell Atmosfera, Rome (Italy).
NUMERICAL METHODS FOR SOLVING DIFFERENTIAL EQUATIONS, APPLIED TO METEOROLOGICAL PROBLEMS [METODI NUMERICI DI RISOLUZIONE DI EQUAZIONI DIFFERENZIALI]
Valerio Parisi Nov. 1977 59 p refs In ITALIAN
(IFA-RDP-20) Avail: NTIS HC A04/MF A01

Numerical approximate methods for differential equations solving are reviewed. The Euler method and its variants are detailed together with the Hermite and the Runge-Kutta methods. For partial differential equations, the finite difference theory is applied to the heat propagation equation and transport theory and the usefulness of the Hermite method for irregular meshes is emphasized. An application to meteorological cases is given. ESA

N78-24223*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN ANALYSIS OF ALTERNATE SYMBOL INVERSION FOR IMPROVED SYMBOL SYNCHRONIZATION IN CONVOLUTIONALLY CODED SYSTEMS

L. D. Baumert, R. J. McEliece, and H. VanTilborg (Technological Univ., Eindhoven, Netherlands) *In its* The Deep Space Network 15 Apr. 1978 p 90-97 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 12A

N78-24230*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON DECODING OF REED-SOLOMON CODES OVER GF(32) AND GF(64) USING THE TRANSFORM TECHNIQUES OF WINOGRAD
I. S. Reed (Univ. of Southern Calif., Los Angeles), T. K. Truong, and B. Benjauthrit *In its* The Deep Space Network 15 Apr. 1978 p 139-171 refs (For availability see N78-24212 15-12)
(Grant AF-AFOSR-2798-75)
Avail: NTIS HC A14/MF A01 CSCL 12A

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N78-24875# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
AN EFFICIENT, ACCURATE NUMERICAL METHOD FOR THE SOLUTION OF A POISSON EQUATION ON A SPHERE Environmental Research Papers, Oct. 1976 - Sep. 1977
Samuel Y. K. Yee 4 Nov. 1977 21 p refs
(AF Proj. 2310)
(AD-A051736; AFGL-TR-77-0246; AFGL-ERP-612) Avail: NTIS HC A02/MF A01 CSCL 12/1

The need for efficient and accurate methods for the solution of boundary value problems such as Poisson-type equations is well established. In numerical weather prediction where solutions to such equations are required in daily routine operations, it is paramount that the solution procedure be efficient. An efficient shooting method to meet such a need has been reported. The algebraic system resulting from the regular discretization of the Poisson equation on a sphere is, however, numerically unstable. Thus the direct application of this method is accurate only for relatively small systems. This limitation has now been successfully removed by two major improvements to the method. The inherent instability of the system due to a spectral radius larger than unity is alleviated by the use of a multiple shooting technique, while the instability due to the convergence of meridians on a sphere is overcome by a specially designed flexible grid. Numerical examples are provided to demonstrate the effectiveness of the improved method. GRA

N78-24876# State Univ. of New York at Buffalo, Amherst. Statistical Science Div.
NONPARAMETRIC STATISTICAL DATA SCIENCE: A UNIFIED APPROACH BASED ON DENSITY ESTIMATION AND TESTING FOR WHITE NOISE
Emanuel Parzen Jan. 1977 63 p refs
(Grant DAAG29-76-G-0239)
(AD-A051090; TR-47; ARO-13845.1-M) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper proposes an approach to non-parametric statistical continuous data science which seems to be consistent with the conventional theories and methods of non-parametric inference but seems to point the way to universally applicable procedures (for continuous data) which are asymptotically as efficient as the best conventional goodness of fit and parameter estimation procedures available for each particular problem. The methods described are programmed and found successful in test cases. However, in the space available here only 'Chapter 1' of this work can be discussed. It outlines the ideas: how the basic general applied problems of statistical inference can be formulated as problems of estimation of distribution functions on the unit interval (or the unit hyper-cube), how such problems are more fruitfully treated as density estimation problems, and how to solve density estimation problems one can use the method which is the essence of the highly successful maximum likelihood method of parameter estimation: using a suitable information-theoretic divergence distance between densities, find the smooth density which is closest to a raw estimator of the density. GRA

N78-24877# Decisions and Designs, Inc., McLean, Va.
ON THE RECONCILIATION OF PROBABILITY ASSESSMENTS
Dennis V. Lindley, Amos Tversky, and Rex V. Brown Feb. 1978 64 p refs
(Contract N00014-75-C-0426; NR Proj. 197-029)
(AD-A051683; TR-77-10-25) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper investigates the question of how to reconcile incoherent probability assessments, i.e., assessments that are inconsistent with the laws of probability. A general model for the analysis of probability assessments is introduced, and two approaches to the reconciliation problem are developed. In the internal approach, one estimates the subject's true probabilities on the basis of his assessments. In the external approach, an external observer updates his own coherent probabilities in the light of the assessments made by the subject. The two approaches are illustrated and discussed. Least-squares procedures for reconciliation are developed within the internal approach.
Author (GRA)

N78-24878# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ONE PROBLEM OF B. V. NEDENKO
D. G. Meyzler 19 Dec. 1977 38 p Transl. into ENGLISH from Ukr. Mat. Zh. (USSR), no. 2, 1949 p 67-84
(AD-A051757; FTD-ID(RS)T-2263-77) Avail: NTIS HC A03/MF A01 CSCL 12/1

To one seminar on probability theory, for the purpose of generalization of already known results of B. V. Nedenkos, was placed the problem of finding the class of maximum laws of maximum term eta sub n first n from sequence of independent differently distributed random variables xi sub n. This problem has direct interest for statistics, namely for that case when experimental conditions vary and the distribution function of the result of the ith observation depends on i. Target/purpose of this work is to give, under some sufficiently general conditions, the solution recently formulated problem. GRA

N78-24879# North Carolina Univ., Charlotte. Dept. of Mathematics.
POSITIVE DEPENDENCE ON THE BIVARIATE AND TRIVARIATE ABSOLUTE NORMAL t, X SQUARED AND F DISTRIBUTIONS Interim Report
M. Abdel-Hameed and Allan R. Sampson (Abbott Labs.) Nov. 1977 18 p refs Submitted for publication
(Grant AF-AFOSR-2999-76; Contracts N00014-76-C-0840; N00014-67-A-0235-0006)
(AD-A051070; AFOSR-78-0330TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is shown that the bivariate density of the absolute normal distribution is totally positive of order 2. Necessary and sufficient conditions are given for the trivariate density of the absolute normal distribution to be totally positive of order 2 in pairs of arguments. These results are then used to show that certain generalized bivariate and trivariate t, X-squared and F random variables are associated. Author (GRA)

N78-24880# State Univ. of New York, Binghamton. Dept. of Mathematical Sciences.
THE FUNCTIONAL RELATIONSHIP BETWEEN DISTRIBUTION FUNCTIONS WITH APPLICATIONS Final Report
David L. Hanson Mar. 1978 5 p
(Contract N00014-76-C-0791)
(AD-A052368) Avail: NTIS HC A02/MF A01 CSCL 12/1

Let F and G be two distribution functions. Under certain circumstances there exists a function h: (O,I) yields (O,I) such that G = hF. In that case G and F can be taken to be, respectively, the distribution functions of an object under normal conditions and conditions causing accelerated aging. Presumably one would have a fairly good idea of F from testing; an estimate of h would then provide an estimate of G. It is also possible that h might be determined from theoretical considerations in which case an estimate of F would provide an estimate of G. Finally, it is possible that estimates of h could provide insights into the aging process itself. GRA

N78-24881# Florida State Univ., Tallahassee. Dept. of Statistics.
ASYMPTOTIC BEHAVIOR OF INTERMEDIATE ORDER STATISTICS: THE INFINITE ENDPOINT CASE
Vernon Watts Oct. 1977 14 p refs
(Contract N00014-76-C-0608)
(AD-A052314; FSU-Statistics-M436; TR-125-ONR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Suppose X1, X2, ... is a sequence of independent and identically distributed random variables with marginal distribution function F(x) = P(X1 < or = x) satisfying F(x) = 0 for all real x. Let X(k sub n) superscript n denote the (k sub n)th smallest order statistic of the sample X1, ..., Xn, where k sub n/n approaches 0 as n approaches infinity. An almost sure representation of X(k sub n) superscript n in terms of the empirical distribution function is established. The conditions imposed upon F include those under which it is known that X(k sub n) superscript n is asymptotically normal. From the representation the law of the iterated logarithm for X(k sub n) superscript n is obtained. Examples illustrating the general result are presented. Author (GRA)

N78-24882# North Carolina Univ., Chapel Hill. Inst. of Statistics.
EXTREME VALUE DISTRIBUTION FOR NORMALIZED SUMS FROM STATIONARY GAUSSIAN SEQUENCES
Yashaswini Mittal Mar. 1978 30 p refs
(Contract N00014-75-C-0809)
(AD-A052831; Mimeo-Ser-1160) Avail: NTIS HC A03/MF A01 CSCL 12/1

Limiting distribution of the maximum of normalized sums of stationary Gaussian processes is studied. Author (GRA)

N78-24883# Florida State Univ., Tallahassee. Dept. of Statistics.
A COMPARISON OF TWO SAMPLING SCHEMES WHEN TESTING A SIMPLE HYPOTHESIS VERSUS A SIMPLE ALTERNATIVE
James Lynch and Jayaram Sethuraman Aug. 1977 21 p refs
Prepared in cooperation with Pennsylvania State Univ., Univ. Park
(Grants DAAG29-76-G-0238; PHS-5-T01-GM0-0913)
(AD-A052811; FSU-TR-424; ARO-13888.9-MX; TR-23) Avail: NTIS HC A02/MF A01 CSCL 12/1

A large deviation result is established for sequences of random variables with random indices. This result is used to compare two different sampling schemes when testing for a simple hypothesis versus a simple alternative. It turns out that the sampling scheme yielding more expected number of observations for the same sampling cost is not necessarily the more profitable procedure. Properties other than the mean of the distribution of the occurrence of the observations play a role in determining the more profitable sampling rule. Author (GRA)

N78-24884# National Range Operations Directorate, White Sands Missile Range, N. Mex. Mathematical Services Branch.
APPLICATION OF ROBUST STATISTICAL METHODS TO DATA REDUCTION
William S. Agee and Robert H. Turner Mar. 1978 26 p refs
(AD-A052543; ACD-TR-65) Avail: NTIS HC A03/MF A01 CSCL 12/1

Robust Statistics provides a fresh approach to the difficult problem of editing in data reduction. Of prime concern are grossly erroneous measurements which, when undetected, completely destroy automated data reduction procedures causing costly reruns and time delays with human detection of the erroneous measurements. The application of robust statistical methods has been highly successful in dealing with this problem. An introduction to the robust M-estimates and their numerical computation is given. The application of M-estimates to data preprocessing, instrument calibration, N-station cinetheodolites, N-station radar solution, and filtering are described in detail. Numerical examples of these applications using real measurements are given. Author (GRA)

N78-24885# Florida State Univ., Tallahassee. Dept. of Statistics.
ON THE BERRY-ESSEEN THEOREM FOR SIMPLE LINEAR RANK STATISTICS
R. J. Serfling Aug. 1977 22 p refs
(Contract N00014-76-C-0608)
(AD-A052320; FSU-Statistics-M425; TR-121-ONR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The rate of convergence O(N to the power -1/2 delta) for any delta = 0 is established for two theorems on asymptotic normality of simple linear rank statistics. These pertain to smooth and bounded scores, arbitrary regression constants, and broad conditions on the distributions of individual observations. The present development provides some alternative arguments of proof, and provides explicit application to relax the conditions of a theorem given the above rate for the case of location-shift alternatives. GRA

N78-24886# Florida State Univ., Tallahassee. Dept. of Statistics.
THE WEAK REPRESENTATION OF INTERMEDIATE ORDER STATISTICS
Vernon Watts Dec. 1977 15 p refs
(Contracts N00014-76-C-0608; N00014-75-C-0809)
(AD-A052315; FSU-Statistics-M443; TR-128-ONR) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is shown that under certain conditions a sample intermediate order statistic of a sequence of random variables has a representation in terms of the empirical distribution function and a remainder which is stochastically of small order. The methods employed yield readily to the general setting of sequences which are m-dependent and not necessarily identically distributed. Under the assumptions it follows from the representation that the sequence of intermediate order statistics is asymptotically normal. Author (GRA)

N78-24887# Florida State Univ., Tallahassee. Dept. of Statistics.
ON THE STRONG LAW OF LARGE NUMBERS AND RELATED RESULTS FOR QUASI-STATIONARY SEQUENCES
R. J. Serfling Aug. 1977 13 p refs
(Contract N00014-76-C-0608)
(AD-A052313; FSU-Statistics-M430; ONR-TR-123) Avail: NTIS HC A02/MF A01 CSCL 12/1

Under second moment assumptions and weak dependence conditions on a sequence of random variables [X sub 1], Gaposkin (1975) has established almost sure convergence of the series sum from 1 to infinity of lambda sub k X sub k under certain restrictions on the rate of convergence to 0 of the constants [C sub k]. Similarly, Moricz (1977) has established conditions for the almost sure convergence to 0 of the sequence (lambda sub n)(sum from 1 to n of X sub k). In the present paper, some extensions of these results are obtained. GRA

N78-24888# Florida State Univ., Tallahassee. Dept. of Statistics.
ON THE SECOND MOMENT OF THE REMAINDER TERM APPEARING IN THE INTERMEDIATE ORDER STATISTIC REPRESENTATION
Vernon Watts Feb. 1978 11 p refs
(Contract N00014-76-C-0608)
(AD-A052318; FSU-Statistics-M457; ONR-TR-131) Avail: NTIS HC A02/MF A01 CSCL 12/1

Under certain conditions a sample intermediate order statistic from a sequence of independent and identically distributed random variables has an almost sure representation involving the empirical distribution and a remainder term of small order. In this paper an asymptotic approximation of the second moment of the remainder term is obtained. It is assumed that the marginal distribution function of the independent and identically distributed sequence has a finite left endpoint. Author (GRA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N78-24889# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.

BASIC STUDIES IN COMBINATORIAL AND NONDIFFERENTIABLE OPTIMIZATION Annual Technical Report, 1 Jul. 1976 - 30 Jun. 1977
Jeremy F. Shapiro Mar. 1978 55 p refs
(Contract DAAG29-76-C-0064)
(AD-A052777; ARO-14261.7-M) Avail: NTIS
HC A04/MF A01 CSCL 12/2

Research activities discussed: mathematical methods; mathematical programming and optimal control; decision analysis, statistics and stochastic systems; models and applications; urban and other public systems; traffic and transportation; industrial and management systems; energy; economics; and computation. Author (GRA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N78-24890# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
OBSERVATIONS ON THE MINIMUM SPHERE PROBLEM
Donald Hearn May 1977 22 p refs
(Grants DAAHC04-75-G-0150; NSF ENG-74-22159)
(AD-A051759; RR-77-5; ARO-12640.26-M) Avail: NTIS
HC A02/MF A01 CSCL 12/1

For a subset A of Euclidean n-space, the location problem of finding the point x which minimizes the maximum distance d(x, a) for a in A may be interpreted as finding the smallest sphere which encloses A. Algorithms have previously been developed for the situations when A is finite or a polytope. Here we concentrate on interpretations and properties of the problem, particularly its relation to other problems: cases where the sphere problem is dual to that of finding a shortest vector in A, where there is a connection with a maximum moment-of-inertia problem, etc. Conjectures, relating the minimum sphere to points in A which define the diameter of A, are also discussed. Author (GRA)

N78-24891# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ON THE PERFORMANCE OF SOME SUBSET SELECTION PROCEDURES
Shanti S. Gupta and Jason C. Hsu Nov. 1977 19 p refs
Prepared in cooperation with Ohio State Univ.
(Contract N00014-75-C-0455)
(AD-A051787; Mimeo-Ser-519) Avail: NTIS
HC A02/MF A01 CSCL 12/1

This paper restricts attention to the problem of selecting a subset of normal populations. The approaches and results of some previous studies of subset selection procedures are discussed briefly. And then the result of a new Monte Carlo study is presented. GRA

N78-24892# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
LOCALLY OPTIMAL SUBSET SELECTION PROCEDURES BASED ON RANKS
Shanti S. Gupta and Deng-Yuan Huang Sep. 1977 16 p refs
(Contract N00014-75-C-0455)
(AD-A051784; Mimeo-Ser-513) Avail: NTIS
HC A02/MF A01 CSCL 12/1

This paper deals with subset selection rules based on ranks in the pooled sample. The procedures satisfy the P-condition and also locally maximize the probability of a correct selection. An application to a problem in regression analysis is provided. Author (GRA)

N78-24893# Naval Postgraduate School, Monterey, Calif.
REPRODUCING KERNEL FUNCTIONS OF THE SARD CORNER SPACES B >p,q< Interim Report, Jan. - Mar. 1978
Richard Franke Mar. 1978 11 p refs
(RR0000101)
(AD-A052226; NPS53-78-001) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The reproducing kernel functions for the Sard corner spaces B > - p, q < are integrated to obtain explicit expressions. The smoothness properties of these functions are discussed. Author (GRA)

N78-24894# South Carolina Univ., Columbia. Dept. of Mathematics and Computer Science.
REMARKS ON THE ASYMPTOTIC BEHAVIOR OF SOLUTIONS TO DAMPED WAVE EQUATIONS IN HILBERT SPACE
Frederick Bloom 1978 16 p refs
(Grant AF-AFOSR-3396-77)
(AD-A052595; AFOSR-78-0486TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Lower bounds are derived for the norms of solutions to a class of initial-value problems associated with the damped wave equation u sub tt + Au sub t + Bu = 0 in Hilbert space. Under appropriate assumptions on the linear operator B it is shown that even in the special strongly damped case where A = Gamma I, T Gamma > 0, solutions are bounded way from zero as t approaches plus infinity, even when Gamma approaches plus infinity. Author

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N78-24895# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
ON THE LIMIT DYNAMICS OF SYSTEMS WITH INFINITE MULTIPLE DEGREES OF FREEDOM
Werner Adolf Braun 1977 73 p refs In GERMAN
(Diss-5897) Avail: NTIS HC A04/MF A01

Using N to the minus 2 power phi (g sub i - g sub j) regular pair interactions it is shown that for n approaching infinity the Vlasovdynamics is the omega meson resonances -limit of the classical canonical N-particle-dynamics. Propagation of molecular chaos holds in this limit and the fluctuations converge to a Gaussian stochastic process, which is, however, non-Markovian. A model of a nerve membrane is studied in the limit of singular interaction with Fermion reservoirs. The resulting axon equations have the same structure as the Hodgkin Huxley equations. Recently proven theorems are used on nonlinear diffusion equations to show the existance of a propagating pulse solution. Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N78-24896# Toronto Univ. (Ontario).
SUBJECTIVE LOUDNESS OF SONIC-BOOM: N-WAVE AND MINIMIZED (LOW-BOOM) SIGNATURES
A. Niedzwiecki and H. S. Ribner Nov. 1977 27 p refs
(UTIAS-TN-215; CN-ISSN-0082-5263) Avail: NTIS
HC A03/MF A01

A loudspeaker-driven simulation booth with extended rise-time capability (down to 0.22 ms) was used for subjective loudness tests of sonic booms. Test series 1 compared N-waves over a range of 0.22 to 10 ms rise time, 100 to 250 ms duration and 0.5 to 2.0 psf (24 to 96 N/sqm) peak overpressure. Tradeoff between rise time and overpressure was measured for equal loudness, as well as the tradeoff between duration and overpressure. For equal loudness 10 ms rise time required 8 db higher overpressure than for 1 ms rise time. Duration had little effect in the range 100 to 200 ms but at 250 ms noticeably enhanced the loudness. Test series 2 compared certain flat-top sonic boom signatures with a reference N-wave (0.5 psf, 1 ms rise time, 150 ms duration). For equal subjective loudness, flat top vs. N-wave, the peak amplitude of the flat top signature

was substantially higher than that of the N-wave; thus for equal amplitude the flat-top signature was quieter. Author

N78-24897*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACOUSTIC EVALUATION OF A NOVEL SWEPT-ROTOR FAN
James G. Lucas, Richard P. Woodward, and Michael J. Mackinnon 1978 24 p refs Proposed for Presentation at 11th Fluid and Plasma Dyn. Conf., Seattle, 10-12 Jul. 1978; sponsored by AIAA
(NASA-TM-78878; E-9612; AIAA-Paper-78-1121) Avail: NTIS HC A02/MF A01 CSCL 20A

Inlet noise and aerodynamic performance are presented for a high tip speed fan designed with rotor blade leading edge sweep that gives a subsonic component of inlet Mach number normal to the edge at all radii. The intent of the design was to minimize the generation of rotor leading edge shock waves thereby minimizing multiple pure tone noise. Sound power level and spectral comparisons are made with several high-speed fans of conventional design. Results show multiple pure tone noise at levels below those of some of the other fans and this noise was initiated at a higher tip speed. Aerodynamic performance of the fan did not meet design goals for this first build which applied conventional design procedures to the swept fan geometry. Author

N78-24898*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THREE-DIMENSIONAL EFFECTS ON PURE TONE FAN NOISE DUE TO INFLOW DISTORTION
Hiroshi Kobayashi 1978 26 p refs Proposed for presentation at the Eleventh Fluid and Plasma Dyn. Conf., Seattle, 10-12 Jul. 1978, sponsored by AIAA
(NASA-TM-78885; E-9618) Avail: NTIS HC A03/MF A01 CSCL 20A

Two dimensional, quasi three dimensional and three dimensional theories for the prediction of pure tone fan noise due to the interaction of inflow distortion with a subsonic annular blade row were studied with the aid of an unsteady three dimensional lifting surface theory. The effects of compact and noncompact source distributions on pure tone fan noise in an annular cascade were investigated. Numerical results show that the strip theory and quasi three-dimensional theory are reasonably adequate for fan noise prediction. The quasi three-dimensional method is more accurate for acoustic power and model structure prediction with an acoustic power estimation error of about plus or minus 2 db. Author

N78-24899# DyTec Engineering, Inc., Huntington Beach, Calif.
ATMOSPHERIC-ABSORPTION ADJUSTMENT PROCEDURE FOR AIRCRAFT FLYOVER NOISE MEASUREMENTS Final Report, May - Sep. 1977
Alan H. Marsh Dec. 1977 89 p refs
(W1-77-5660-1)
(AD-A051700; DyTec-R-7705; FAA-RD-77-167) Avail: NTIS HC A05/MF A01 CSCL 20A

An analytical method was developed for adjusting measured aircraft noise levels for differences in atmospheric absorption between test and reference meteorological conditions along the sound propagation path. The method is based on the procedure in the proposed American National Standard ANS S1.26 for calculating pure-tone sound absorption as a function of the frequency of the sound and the temperature, humidity, and pressure of the air. Measured aircraft noise levels are assumed to be 1/3-octave-band sound pressure levels. A computer program was written in FORTRAN IV to carry out the calculations. The operation of the computer program, the required input data, and all symbols and terms used in the program are described. A program listing of source statements is provided. Recommendations are given for applying the method to routine processing of aircraft noise measurements. Author

N78-24900*# Boeing Commercial Airplane Co., Seattle, Wash.
LOW FREQUENCY CABIN NOISE REDUCTION BASED ON THE INTRINSIC STRUCTURAL TUNING CONCEPT: THE THEORY AND THE EXPERIMENTAL RESULTS, PHASE 2
G. SenGupta Mar. 1978 104 p refs Sponsored in part by NASA
(Contract F33657-72-C-0829)
(NASA-CR-145262; D6-44283; D748-10113-3) Avail: NTIS HC A06/MF A01 CSCL 20A

Low frequency cabin noise and sonically induced stresses in an aircraft fuselage may be reduced by intrinsic tuning of the various structural members such as the skin, stringers, and frames and then applying damping treatments on these members. The concept is also useful in identifying the key structural resonance mechanisms controlling the fuselage response to broadband random excitation and in developing suitable damping treatments for reducing the structural response in various frequency ranges. The mathematical proof of the concept and the results of some laboratory and field tests on a group of skin-stringer panels are described. In the so-called stiffness-controlled region, the noise transmission may actually be controlled by stiffener resonances, depending upon the relationship between the natural frequencies of the skin bay and the stiffeners. Therefore, cabin noise in the stiffness-controlled region may be effectively reduced by applying damping treatments on the stiffeners. Author

N78-24901*# National Aeronautics and Space Administration, Washington, D. C.
SOUND PROPAGATION IN A DUCT OF PERIODIC WALL STRUCTURE
U. Kurze May 1978 29 p refs Transl. into ENGLISH from Acustica (West Germany), v. 21, no. 2, 1969 p 74-85 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Bolt, Beranek and Newman, Inc., Cambridge, Mass.
(Contract NASw-2790)
(NASA-TM-75284) Avail: NTIS HC A03/MF A01 CSCL 20A

A boundary condition, which accounts for the coupling in the sections behind the duct boundary, is given for the sound-absorbing duct with a periodic structure of the wall lining and using regular partition walls. The soundfield in the duct is suitably described by the method of differences. For locally active walls this renders an explicit approximate solution for the propagation constant. Coupling may be accounted for by the method of differences in a clear manner. Numerical results agree with measurements and yield information which has technical applications. Author

N78-24902*# National Aeronautics and Space Administration, Washington, D. C.
CRITERIA FOR THE SELECTION OF FOCUSING ULTRASONIC PROBES
U. Schlengermann May 1978 18 p refs Transl. into ENGLISH from Materialpruefung (West Germany), v. 19, Oct. 1977 p 416-420 Original language document was announced as A78-11968 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75309) Avail: NTIS HC A02/MF A01 CSCL 20A

The principles of operation employed in the focusing of a sound field are considered, taking into account the use of solid and liquid coupling media. The focusing limits for a given transducer are investigated. As a diffraction phenomenon, focusing is a function of the system dimensions, the frequency, and the sound velocity. The frequency and the material used for the lenses are in most cases determined in accordance with considerations regarding sound propagation. Changes in the focus are therefore effected mainly by the selection of transducer and lens dimensions. The functions of the focusing factor for a normal immersion probe and a direct contact angle probe are represented in graphs. The deviation of the appropriate parametric values for an ultrasonic probe is illustrated with the aid of examples. Author

N78-24903*# Boeing Vertol Co., Philadelphia, Pa.
EVALUATION OF THE ANNOYANCE DUE TO HELICOPTER ROTOR NOISE Final Report
Harry Sternfeld, Jr. and Linda Bukowski Doyle Washington NASA Jun. 1978 74 p refs
(Contract NAS1-14192)
(NASA-CR-3001) Avail: NTIS HC A03/MF A01 CSCL 20A

A program was conducted in which 25 test subjects adjusted the levels of various helicopter rotor spectra until the combination of the harmonic noise and a broadband background noise was

judged equally annoying as a higher level of the same broadband noise spectrum. The subjective measure of added harmonic noise was equated to the difference in the two levels of broadband noise. The test participants also made subjective evaluations of the rotor noise signatures which they created. The test stimuli consisted of three degrees of rotor impulsiveness, each presented at four blade passage rates. Each of these 12 harmonic sounds was combined with three broadband spectra and was adjusted to match the annoyance of three different sound pressure levels of broadband noise. Analysis of variance indicated that the important variables were level and impulsiveness. Regression analyses indicated that inclusion of crest factor improved correlation between the subjective measures and various objective or physical measures. Author

N78-24904# ARO, Inc., Arnold Air Force Station, Tenn.
DOMINANCE OF RADIATED AERODYNAMIC NOISE ON BOUNDARY-LAYER TRANSITION IN SUPERSONIC-HYPERSONIC WIND TUNNELS. THEORY AND APPLICATION Final Report, Sep. 1975 - Mar. 1977. Ph.D. Thesis - Tennessee Univ., Mar. 1977
Samuel R. Pate Mar. 1978 414 p refs Sponsored by the Air Force
(AD-A052621; AEDC-TR-77-107) Avail: NTIS HC A18/MF A01 CSCL 20/4

An experimental investigation was conducted to determine the effects of radiated aerodynamic-noise on boundary-layer transition in supersonic-hypersonic wind tunnels. It is conclusively shown that the aerodynamic noise (pressure fluctuations associated with sound waves), which radiates from the tunnel wall, turbulent boundary layer, will dominate the transition process on sharp flat places and sharp slender cones at zero incidence. GRA

N78-24905# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THEORETICAL AND EXPERIMENTAL STUDIES OF ACOUSTIC PROPAGATION IN INHOMOGENEOUS MOVING MEDIA Ph.D. Thesis - Paris 6 Univ.
Sebastien Candel 1977 116 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-477)
(ONERA-P-1977-1; FR-ISSN-0078-379X) Avail: NTIS HC A06/MF A01

Three problems are treated in particular: the propagation of plane and modal pressure waves in nozzles and diffusers, the radiation of the jet noise high-frequency components, and the propagation of an acoustic field in the free flow of an open wind tunnel. A numerical algorithm based on the geometrical approximation was developed and allows the calculation of the wave field (amplitude and phase) in the case of very general media (inhomogeneous, dispersive, including reflecting surfaces). A comparison between calculations and experimental results obtained in an open wind tunnel was made to check the proposed numerical method and to demonstrate its practical utility. Author (ESA)

N78-25034# Joint Publications Research Service, Arlington, Va.
ANALYSIS OF A COMPRESSION SYSTEM WITH DISCRETE FREQUENCY MODULATION IN SURFACE ACOUSTICAL WAVES
V. T. Pershin, V. G. Basov, and V. N. Sinitsa *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 36 (JPRS-71139) 18 May 1978 p 25-29 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (Kiev), v. 21, no. 3, 1977 p 95-97 (For availability see N78-25031 15-99)
Copyright. Avail: Issuing Activity

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N78-24906*# National Aeronautics and Space Administration. Pasadena Office, Calif.
NEGATIVE ION SOURCE Patent Application
Raymond Goldstein (JPL) and James E. Graf, inventors (to NASA) (JPL) Filed 28 Apr. 1978 15 p
(Contract NAS7-100)
(NASA-Case-NPO-14113-1; US-Patent-Appl-SN-900848) Avail: NTIS HC A02/MF A01 CSCL 20H

This invention relates to an improved negative ion source and, more particularly to a system including said ionizer in combination with dissociator, separator and neutralizating means for providing an energetic neutral beam for a controlled thermonuclear reactor (CTR). The negative ion source in accordance with this invention includes a porous ionizer material configured such that the neutral source gas flows through it, rather than impinging on it. The material can be configured as a porous plug, rolled foil or bundle of wires. The material is in the form of a high work function material such as nickel, tungsten, or tantalum coated with a film of low work function material such as CsO, BaO/SrO. By using such a configuration, an increased portion of the source gas such as deuterium is ionized while the negatively excited deuterium ion beam is better collimated and has a higher current density. A complete system employing a porous, low work function surface ionizer in the production of a high energy neutral beam is shown. NASA

N78-24907# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
AN ATOMIC HYDROGEN SUPERSONIC NOZZLE BEAM SOURCE
John Potjewyd Mar. 1978 77 p refs
(UTIAS-TN-220; CN-ISSN-0082-5255) Avail: NTIS HC A05/MF A01

An atomic hydrogen supersonic nozzle beam source was designed, built and tested. Operating up to 3000K, it produces a high degree of dissociation and high atomic hydrogen density at high velocity. The choice of operating modes, either operation in an inverse seeded mode with helium or as an atomic hydrogen beam depends on end use requirements of beam velocity, degree of dissociation, or maximization of atomic hydrogen flux. A seeded beam velocity of 7.06 km/sec was indicated at an experimentally determined degree of dissociation of 0.75. At the mass spectrometer detector station 50 centimeters downstream of the nozzle, this corresponds to 3.013 x 10 to the 14th power hydrogen atoms/sq cm/sec flux. The source operated with pure hydrogen at higher pressures will produce an estimated 9.1 km/sec beam. At much smaller source Knudsen numbers, an atomic hydrogen flux of 8.46 x 10 to the 15th power atoms/sq cm/sec is theoretically possible, at an estimated velocity of 10.4 km/sec. Author

N78-24908# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
TWO-ELECTRON TRANSFERS AND MOLECULAR X-RAY RADIATION DURING HEAVY ION COLLISIONS Ph.D. Thesis [ZWEI-ELEKTRONENUEBERGAENGE UND MOLEKULARE ROENTGENSTRAHLUNG BEI SCHWERIONENKOLLISIONEN]
Christian Stoller 1976 87 p refs In GEORGIAN
(Diss-5788) Avail: NTIS HC A05/MF A01

Continuous X-ray emission spectra in heavy ion collisions are attributed to quasi-molecular transfer. Comparisons of single spectrum measurements for Al-Al, Ca-Ca, Cl-Ni, Fe-Ni, Ni-Fe, Ni-Ni, and Ag-Ag collisions agree well with theoretical predictions. Transl. by G.G.

N78-24909# California Univ., Berkeley. Dept. of Chemistry.
CROSSED MOLECULAR BEAM STUDY OF THE REACTIONS OF OXYGEN AND FLUORINE ATOMS Annual Report, Jan. 1977 - Feb. 1978
Yuan T. Lee 1 Mar. 1978 37 p refs
(Contract N00014-75-C-0671)
(AD-A051308; UC-75-C-0671-78) Avail: NTIS HC A03/MF A01 CSCL 20/8

With a high intensity monoenergetic O(3P) beam source developed during the previous contract period, several reactions of oxygen atoms have been carried out by crossed molecular

beams experiments. In the first two sections, the measurements of O + ICl, O + C2H5I and CF3I will be summarized. In addition to obtaining the detailed information on reaction dynamics, there are two very important results worth noting here. The IO bond strength was found to be 53 + or - 1 kcal/mole, rather than 44 + or - 4 kcal/mole listed in NBS tabulation. In O + C2H5I yields C2H5 + IO, the translational energy distributions of IO measured is higher than what was expected from statistical theory. It is much closer to the distribution if one neglects all vibrational degrees of freedom involving hydrogen atoms. In the third section, further studies on the intramolecular energy transfers in chemically activated radicals will be summarized. A series of experiments including Cl + 1+gromopropene, Cl - 2-bromopropene and Cl + 3-bromopropene were carried out. Here demonstrated again, from the measurement of the translational energy distribution, high frequency vibrations which involve H-atoms do not share activation energy effectively before decomposition. GRA

N78-24910# Naval Research Lab., Washington, D. C.
STUDIES OF ION BEAM GENERATION EFFICIENCY WITH REFLEX TETRODES
R. A. Mahaffey, J. A. Pasour, J. Golden, and C. A. Kapetanakos Jan. 1978 15 p refs
(RR0110941)
(AD-A051303; AD-E000119; NRL-MR-3694) Avail: NTIS HC A02/MF A01 CSCL 20/7

The unidirectionality of the ion current in a reflex tetrode has as a result the efficient generation of pulsed, ion beams. In this paper, experimental results are reported on the dependence of the ion generation efficiency, in a reflex tetrode, upon the applied voltage, total current, anode-anode and anode-cathode separations and applied magnetic field. Author (GRA)

N78-24911# Surrey Univ., Guildford (England).
STRUCTURE AND NITRATION OF SOME AZA-SUBSTITUTED ADAMANTANES Final Report, Sep. 1976 - Sep. 1977
G. A. Webb Sep. 1977 26 p refs
(Grant DA-ERO-75-G-039; DA Proj. 1T1-61102-B-13B)
(AD-A047488) Avail: NTIS HC A02/MF A01 CSCL 07/3

The preparation of a series of 7-substituted-1,3,5-triazaadamantanes is described. The compounds are characterised by means of NMR and IR spectroscopic studies and microanalytical data. Carbon 13 and Hydrogen 1 NMR data provide conformational information on the 1,3,5-triazaadamantanes. Five different nitration media are employed in the study of nitration reactions. Various products are isolated depending upon reaction conditions and studied by means of NMR spectroscopy. Attempts to observe intermediates in the nitration reactions by means of Hydrogen 1 NMR are not successful. Author (GRA)

N78-24912# Naval Research Lab., Washington, D. C. Experimental Plasma Physics Branch.
RADIALLY CONVERGENT PROTON BEAMS FROM A CYLINDRICAL DOUBLE DIODE Interim Report
Jeffry Golden, Redge A. Mahaffey, S. J. Marsh, and Christos A. Kapetanakos Feb. 1978 17 p refs
(RR0110941)
(AD-A052555; AD-E000128; NRL-MR-3711) Avail: NTIS HC A02/MF A01 CSCL 20/8

A cylindrical double diode is used to produce a radially convergent proton beam. This device exhibits both pinching and, to a lesser degree, reflexing of the electrons. The proton current density incident on the inner cathode is larger than the ion current density anticipated for bipolar space charge flow. The current density of ions extracted through the cathode has been intensified by at least a factor of 7 as a result of geometric focusing. Author (GRA)

N78-24913# Naval Research Lab., Washington, D. C. Plasma Dynamics Branch.
COMPUTER SIMULATION OF SPACE CHARGE EFFECTS IN PARTICLE ACCELERATORS Interim Report
Irving Haber Jan. 1978 19 p refs Sponsored in part by DOE
(AD-A052554; AD-E000131; NRL-MR-3705) Avail: NTIS HC A02/MF A01 CSCL 20/7

The potential use of high energy ion beams as a source of thermonuclear pellet ignition energy has increased the importance of understanding high current beam transport. Computer simulation using particle codes promises to be a useful tool in gaining that understanding. A series of simulations is presented in which the numerical parameters are systematically varied to illustrate the purely numerical effects on these simulations in a physically interesting parameter range. It is found that the significant effects observed are essentially independent of the numerical parameters. It therefore appears that the numerical techniques are indeed capable of reliably predicting the behavior of actual beam transport systems. Author (GRA)

N78-24914# Texas Instruments, Inc., Dallas.
IC FABRICATION USING ELECTRON-BEAM TECHNOLOGY Quarterly Report, 1 Jul. - 1 Oct. 1976
Gilbert L. Varnell, Ronald A. Williamson, Terry L. Brewer, John L. Bartelt, Richard J. Dexter, R. A. Robbins, and C. D. Winborn Jan. 1977 45 p
(Contract DAAB07-76-C-8105)
(AD-A052432; TI-03-77-02; QR-1) Avail: NTIS HC A03/MF A01 CSCL 09/1

A program to implement e-beam writing technology for fabrication of microcircuits has been initiated this quarter. The technical and economic impact of electron-beam direct slice printing will be demonstrated on 256 bit bipolar RAMs utilizing an electron-beam machine (EBMIIIA). Earlier this year a new high-speed interface was installed on EBMIII to allow up to 5 micrometers/microsec scan rates and 0.5 micrometers line spacings. This corresponds to a data rate of 10 MHz at 0.5 micrometers spacings and 20 MHz at 0.25 micrometers spacings. The conceptual design of an automatic slice loading system has been completed. This would allow slice loading from standard boats under computer control with no operator intervention. This will reduce total cycle time and reduce system downtime since at present the entire chamber is exposed to the atmosphere during slice loading. The proposed IC for this contract is a single monolithic integrated circuit containing a 256 word by 1 bit fully static random access nondestructive readout memory. The memory if fully decoded requires only 8 address lines to select one of 256 storage locations. An additional line, write enable, is provided to enable the memory to modify the stored data. Separate Data Input and Data Output lines are provided for minimum interaction between input and output functions. Three chip enable lines are provided to simplify the decoding required to achieve the desired system. GRA

N78-24915# Brookhaven National Lab., Upton, N. Y.
NEUTRON SCATTERING STUDIES OF ELECTRON-PHONON INTERACTIONS
J. D. Axe 1977 16 p refs
(Contract EY-76-C-02-0016)
(BNL-23019) Avail: NTIS HC A02/MF A01

Areas in which neutron scattering has been used to study electron-phonon interactions are reviewed. The most obvious way in which this interaction manifests itself is in the phonon dispersion of metals. Because Born-von Karman models are both unwieldy and unphysical, it is more satisfactory to formulate models in which conduction electron-phonon interactions are dealt with explicitly. In harmonic approximation, phonon frequencies and eigenvectors are obtained by diagonalizing a dynamical matrix. The effective electron screening potential of sodium metal is discussed, as well as the neutron spectroscopy of superconductors. Author

N78-24916# Laboratoire de Physique Nucleaire des Hautes Energies, Palaiseau (France).
BARYON EXCHANGE IN THE REACTION Pi (-) PROTON YIELDS N* (0) Pi (0) AT 9 AND 12 GeVc
A. Rouge, G. DeRosny, P. Fleury, B. Eisenstein, P. Briandet, P. Benkheiri, P. Rivet (Coll. de France), A. Volte (Coll de France), B. Bouquet (Lab. de l'Accelerateur Lineaire, Orsay, France), B. Dalmagne (Lab. de l'Accelerateur Lineaire, Orsay, France) et al 1977 6 p refs Submitted for publication
(LPNHE/X/77-01) Avail: NTIS HC A02/MF A01

In Pi (-) proton interactions at 9 and 12 GeV/c, the forward production of N star 1520 was observed with features of nuclear exchange. The production of Delta 1232 is strongly

suppressed. The invariant mass spectra of the proton-Pi (-) are well described by a superposition of a smooth background and three Breit-Wigner shapes. Differential cross sections are given together with decay angular distributions in the Jackson frame. ESA

N78-24917# Laboratoire de Physique Nucleaire des Hautes Energies, Palaiseau (France).
BACKWARD Rho (-) PRODUCTION IN THE REACTION Pi (-) PROTON YIELDS PROTON Pi (-) Pi (0) AT 9 AND 12 GeVc
P. Benkheiri, B. Eisenstein, P. Fleury, G. DeRosny, A. Rouge, J. M. Thenard, H. Yoshida, D. Treille (CERN), P. Rivet (Coll. de France), A. Volte (Coll. de France) et al 1977 6 p refs Submitted for publication
(LPNHE/X/77-03) Avail: NTIS HC A02/MF A01

The differential cross section and the density matrices of the backward produced Rho (-) were measured in a high statistics experiment with incident Pi (-) of a 9 and 12 GeV/c. Monte Carlo methods were used to correct the experimental distribution, taking into account the cuts resulting from the acceptance of the experimental set up. One prong and two prong events were considered. ESA

N78-24918# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
MAGNETIC ROTATION AND LASER INDUCED FLUORESCENCE SPECTROSCOPY OF THE RED, BLUE AND VIOLET BAND SYSTEMS OF THE Rb2 MOLECULE [MAGNETISCHE ROTATIONS- UND LASERINDUZIERTE FLUORESZENZ-SPEKTROSKOPIE AN DEN ROTEN, BLAUEN UND VIOLETTEN BANDENSYSTEMEN DES Rb2-MOLEKUELS]
Dubravka Kotnik-Karuza Nov. 1977 162 p refs In GERMAN
(MPI-PAE/Extraterr-138) Avail: NTIS HC A08/MF A01

Rb2 molecules were produced in a heat pipe oven and their magnetic rotation spectra, laser induced fluorescence spectra, and absorption spectra were investigated in the visible spectral range. Two band systems were observed in absorption in the red spectral range. A correlation method was developed to determine term values in the excited state based on the ground state. The method was tested for the red band system. The blue and violet band systems were examined in absorption, magnetic rotation, and resonance fluorescence. The magnetic rotation spectra were analyzed with the correlation method. Fluorescence spectra of both systems were observed and measured photographically and photoelectrically. ESA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N78-24919# Comptroller General of the United States, Washington, D.C.
NUCLEAR ENERGY'S DILEMMA: DISPOSING OF HAZARDOUS RADIOACTIVE WASTE SAFELY
Washington GPO 9 Sep. 1977 95 p refs Rept. to the Congress
(EMD-77-41) Avail: US Capitol, Senate Document Room

Efforts of the Energy Research and Development Administration and the Nuclear Regulatory Commission to solve the critical problem of disposing of radioactive wastes generated from commercial and military nuclear operations, and their handling of the large backlog of spent nuclear fuels are discussed. Topics covered include: sources of radioactive waste; lack of authority over all waste storage and disposal activities; disposal of military and research-related wastes; management of commercial spent fuel; obstacles to geological waste disposal; and recommendations for Congressional Action. Author

N78-24920# Argonne National Lab., Ill.
ALTERNATIVE FUEL CYCLE OPTIONS: PERFORMANCE CHARACTERISTICS AND IMPACT ON NUCLEAR POWER GROWTH POTENTIAL
Y. I. Chang, C. E. Till, R. R. Rudolph, J. R. Deen, and M. J. King Sep. 1977 43 p refs
(Contract W-31-109-eng-38)
(ANL-77-70) Avail: NTIS HC A03/MF A01

The fuel utilization characteristics for LWR, SSCR, CANDU and LMFBR reactor concepts are quantified for various fuel cycle options, including once-through cycles, thorium cycles, and denatured cycles. The implications of various alternative reactor deployment strategies on the long-term nuclear power growth potential are then quantified in terms of the maximum nuclear capacity that can be achieved and the growth pattern over time, subject to the constraint of a fixed uranium-resource base. The overall objective was to shed light on any large differences in the long-term potential that exists between various alternative reactor/fuel cycle deployment strategies. ERA

N78-24921# Laboratoire de Physique Theorique et Particules Elementaires, Orsay (France).
CLUSTERING AND CLUSTERS
Andre Krzywicki Nov. 1976 19 p refs Presented at the Intern. Summer Inst. for Theoret. Phys., Bielefeld, West Ger., 23 Aug. - 4 Sep. 1976
(LPTPE-76/25) Avail: NTIS HC A02/MF A01

The theory of one-dimensional random point processes is reviewed with regard to statistical sets and relative density matrices, exclusive and inclusive probabilities together with the generating functional, correlation functions, multiplicity and rapidity gap distributions, short range order (SRO) theory, and cluster-emission models. The dynamical meaning and limitations of SRO are discussed. The concept of local compensation of quantum numbers is introduced and applied to the case of hadronic diffraction. General considerations enable determination of the basic features of the cluster model expected to offer the best representation of the true SRO dynamics at asymptotic energies, and comparisons are given with recent fits of data where realistic models were used. Clustering associated with the leading particle effect is discussed. ESA

N78-24922# National Technical Information Service, Springfield, Va.
NUCLEAR MATERIALS SAFEGUARDS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - 1978
George W. Reimherr Mar. 1978 291 p Supersedes NTIS/PS-77/0175; NTIS/PS-76/0201
(NTIS/PS-78/0272; NTIS/PS-77/0175; NTIS/PS-76/0201) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 18H

Citations cover the methods of safeguarding nuclear materials through effective management, accountability, nondestructive assays, instrumentation, and automated continuous inventory systems. Problem areas and recommendations for improving the management of nuclear materials are included. Author

N78-24923# Nuclear Regulatory Commission, Washington, D. C. Office of Management Information and Program Control.
REPORT TO CONGRESS ON ABNORMAL OCCURRENCES JULY - SEPTEMBER 1977
Nov. 1977 22 p
(PB-278534; Nureg-0090-9) Avail: NTIS HC A02/MF A01 CSCL 18H

An abnormal occurrence is identified as an unscheduled incident or event which the Nuclear Regulatory Commission determines to be significant from the standpoint of public health or safety. It is determined that during this period there were no abnormal occurrences neither at the 65 nuclear power plants licensed to operate nor at fuel cycle facilities. There was one abnormal occurrence at other licensed facilities, which involved the loss and recovery of a radioactive source and probable preexposure. GRA

74 OPTICS

Includes light phenomena.

N78-24924*# ITT Electro-Optical Products Div., Roanoke, Va.
WIDE TEMPERATURE RANGE FIBER OPTIC CABLE: CABLE DESIGN STUDY
E. U. Speed [1978] 6 p Prepared for JPL
(Contracts NAS7-100; JPL-954843)
(NASA-CR-157061) Avail: NTIS HC A02/MF A01 CSCL 20F

Factors considered in the design and fabrication of a single fiber optic cable intended for spacecraft applications in an environment of temperature extremes from -160 C to 125 C include: abrasion resistance, low temperature flexibility, small size, low weight, and overall temperature stability. Specific requirements were identified for fiber core and overall diameters, fiber loss and NA, and cable tensile load. The single fiber cable will be fabricated by using a chemical vapor step index fiber of .125 mm coated to .3 mm with RTV silicone and then extruded with a jacket of Teflon PFA to a diameter of .5 mm. Six yarns of 1420 denier unimpregnated Kevlar 49 with a helical lay of 1.3 inches will surround the jacketed fiber under an extrusion of PFA. The finished cable diameter will measure 1.8 mm, and the weight of one kilometer length will be approximately 4350 grams. Author

N78-24925# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
CALCULATION OF TRANSFER FUNCTIONS AND QUALITY CRITERIA FOR OPTICAL SYSTEMS Ph.D. Thesis [BERECHNUNG DER UEBERTRAGUNGSFUNKTIONEN UND GUETEKRITERIEN OPTISCHER SYSTEME]
Adolf H. Aemmer 1977 134 p refs In GERMAN; ENGLISH summary
(Diss-5951) Avail: NTIS HC A07/MF A01

The theory of linear systems is applied to incoherent optical imaging. Definition and properties of the point spread function and the Optical Transfer Function (OTF) are summarized. The important sections of the program to calculate the OTF (pupil shape, aberration function, approximation of the aberration function, autocorrelation and quality criteria) are explained with respect to accuracy and calculation time. The discussion of the quality criteria, beginning by explaining the classical ones, describes those which are derived from the OTF. The computed OTF of some photogrammetric lenses leads to a large number of different quality criteria, which have been analyzed by statistical methods. Most of these quality criteria show large correlation, which means that the image quality of an optimal system can be described by a few quality numbers. The relation between the aberration function and a quality criterion based on the OTF is also developed. Author

N78-24926# Naval Research Lab., Washington, D. C.
S201 CATALOG OF FAR-ULTRAVIOLET OBJECTS Final Report
Thornton Page and Richard E. Hill 20 Jan. 1978 166 p refs (RR0340642)
(AD-A051304; AD-E000117; NRL-8173) Avail: NTIS HC A08/MF A01 CSCL 03/2

A catalog of star images was compiled from images obtained by an NRL Far-Ultraviolet Camera/Spectrograph (Experiment S201) operated from 21 to 33 April 1972 on the lunar surface during the Apollo-16 mission. These images were scanned on a microdensitometer, and the output recorded on magnetic tapes. A set of seven computer programs were written to process these recorded outputs in order to compile the catalog. The catalog is divided into 11 parts, covering ten fields in the sky (the Sagittarius field being covered by two parts), and each part is headed by a constellation name and the field center coordinates. The errors in position of the detected images are less than about 3 arc-min. Correlations are given with star numbers in the Smithsonian Astrophysical Observatory catalog. Values are given of the peak density and the density volume (a product of the number of pixels in the image and the density units above background in each pixel). The text includes a discussion of the photometry, corrections thereto due to threshold and saturation effects, and its comparison with theoretical expectation, stellar model atmospheres, and a generalized far-ultraviolet interstellar extinction law. The S201 catalog is also available on a single reel of seven-track magnetic tape. Author (GRA)

N78-24927# California Univ., Berkeley. Electronics Research Lab.
STUDIES OF PERIODIC WAVEGUIDE STRUCTURES FOR GENERATION AND PARAMETRIC INTERACTION OF COHERENT OPTICAL WAVES Final Report, 1 Mar. 1973 - 30 Jun. 1977
Shyh Wang Jun. 1977 8 p refs
(Contracts N00014-75-C-0420; N00014-69-A-0200-1063)
(AD-A051420) Avail: NTIS HC A02/MF A01 CSCL 20/5

The report summarizes contributions in the realization of the DBR laser for integrated optics and in the achievement of 'kink-free' injection lasers. GRA

N78-24928# Xonics, Inc., Santa Monica, Calif.
TABULATION OF IMPURITY ABSORPTION SPECTRA-ULTRAVIOLET AND VISIBLE, VOLUME 2 Technical Report, 1 Jul. - 31 Dec. 1977
H. Vora, M. Flannery, and M. Sparks 31 Dec. 1977 330 p refs
(Contract DAHC15-73-C-0127; DARPA Order 1969)
(AD-A052452; TR-10-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 20/6

The optical-absorption spectra of commonly occurring impurities in several ultraviolet-transparent solids are tabulated and discussed, and the assignments of the absorption bands are reviewed. The wavelength region included extends from the very near infrared, at 1 micrometers (0.124 eV), through the vacuum-ultraviolet region. The host materials covered are LiF, NaF, KCl, MgF2, CaF2, MgO, Al2O3, SiO2, and silicate glasses. The results are presented in a way useful in locating impurities that absorb at specified wavelengths, in determining the wavelength region in which a specific impurity absorbs, and for general use in several current and envisioned programs, including: reducing the residual optical absorption of materials in order to increase the power of ultraviolet and visible lasers and to increase the resistance of materials to damage by high-intensity radiation in laboratory and space environments; understanding the origin of the residual absorption in order to provide guidance for further improvement of materials and to estimate the expected materials limits set by residual imperfections; and reducing the absorptance of dielectric reflectors and antireflection coatings. GRA

N78-24929# Northrop Research and Technology Center, Palos Verdes Peninsula, Calif.
OPTICAL COATINGS 2-6 MICRONS
P. Kraatz Mar. 1978 45 p refs
(Contract N00123-76-C-1321)
(AD-A052450) Avail: NTIS HC A03/MF A01 CSCL 11/3

This report covers the final half-year of the contractual effort (June through December, 1977). It is divided into two major sections covering single layer films and multilayer coatings. Deposition techniques and their optimization, film absorptance, film structure, and resistance to an HF vapor environment are covered in the section on single layer films; absorptance, structure, and preferred orientation are covered in the section on multilayer coatings. GRA

N78-24930# Harry Diamond Labs., Adelphi, Md.
FIBER OPTIC SAFEGUARDS SEALING SYSTEM
R. R. Ulrich Jan. 1978 25 p
(Contracts ACDA-RA-178; AC6AA709)
(AD-A052312; HDL-TR-1847) Avail: NTIS HC A02/MF A01 CSCL 20/6

The Harry Diamond Laboratories continued development work on a tamper-resistant/tamper-indicating safing system for the U.S. Arms Control and Disarmament Agency. The safing system consists of a fiber optic seal and related equipment that assembles, photographs, and identifies the seals in the field. The seals are intended for field use in international safeguards and arms control applications. The report describes improvements in the fiber optic seal assemblies and in the inspection equipment. The inspection equipment includes a means for seal identification by reticle pattern projection that does not require any photographs to be taken of the seal's fingerprints. Also included are: (1) the results of the preliminary environmental tests on the sealing system, and (2) detailed operating procedures for the new fiber optic seal assembly and inspection kits. Author (GRA)

N78-24931# Washington Univ., Seattle. Dept. of Electrical Engineering.
OPTICAL PROPERTIES OF SINGLE MODE RECTANGULAR FIBERS Final Report, 1 Jun. 1976 - 31 Dec. 1978
Carlos A. Kohan, Gordon L. Mitchell, Sinclair S. Yee, and William D. Scott Feb. 1978 73 p refs
(Contract N00123-76-C-1451)
(AD-A052290; UW-EE-TR-207) Avail: NTIS HC A04/MF A01 CSCL 20/6

The optical properties of single-mode rectangular fibers have been studied with the aim of improving past DH laser/fiber coupling efficiency results. By local heating and careful fracturing, short, rectangular-to-round 'transition' fibers can later be obtained for efficient overall laser/round fiber coupling. The power loss due to rounding is known to be as low as 1 db. A method of general applicability has been developed to measure core dimensions and numerical aperture of fibers. Coupling efficiency measurements were performed by a more reliable procedure for differentiating cladding from core output power than what has been generally used. Laser/rectangular fiber efficiencies of 30% with a maximum of 50% have been obtained. If laser fluorescent power is accounted for to compare with other publications, the above figures become 46% and 71% respectively. GRA

N78-24932# Naval Postgraduate School, Monterey, Calif.
SURVEY OF CURRENT TECHNOLOGY RELATED TO FIBER OPTICS M.S. Thesis
Pedro Mackinlay Leiceaga Sep. 1977 103 p refs
(AD-A052653) Avail: NTIS HC A06/MF A01 CSCL 20/6

The historical facts that brought today's scientists to use optical communication systems, and the possible advantages or disadvantages of using fiber optic transmission medium were investigated. The requirements and characteristics of the optical links and the problems related to their implementation were studied. Today's applications as well as the future ones are discussed. An economic analysis and an effectiveness analysis were carried out to establish future trends. Author (GRA)

N78-24933# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
SYNTACTIC ALGORITHMS FOR IMAGE SEGMENTATION AND A SPECIAL COMPUTER ARCHITECTURE FOR IMAGE PROCESSING Interim Report
Janmin Keng and K. S. Fu Dec. 1977 274 p refs
(Grant AF-AFOSR-2661-74)
(AD-A052614; TR-EE77-39; AFOSR-78-0694TR) Avail: NTIS HC A12/MF A01 CSCL 20/6

Several efficient algorithms for image recognition and segmentation and a new computer architecture for image processing are proposed. The algorithms are 'Syntactic' in that they perform structural or spatial analysis rather than statistical analysis, and a 'grammar' is inferred for describing the structures of patterns in an image. Depending on the requirements of the problem, an appropriate grammatical approach is used by the syntactic algorithm. A finite-state string grammar is applied to the image recognition of highways, rivers, bridges, and commercial/industrial areas from LANDSAT images. There are two major methods in the string grammar approach for image recognition; namely, the syntax-directed method and syntax-controlled method. For the syntax directed method, syntactic analysis is performed by a template matching which is directed by the syntactic rules. For the syntax-controlled method an automation which is directly controlled by the syntactic rules is used for the syntactic analysis. A tree grammar is applied to the image segmentation of terrain and tactical targets from LANDSAT and infrared images respectively. The tree grammar approach utilizes a tree automation to extract the boundaries of the homogeneous region segments of the image. The homogeneity of the region segment is obtained through texture measurements of the image. The computer architecture proposed is a special purpose system in that it can perform an image processing task on several picture-points of an image at the same time, and thus takes advantage of the fact that image processing tasks usually exhibit 'parallelism'. This architecture uses a distributed computing approach. GRA

N78-24934# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
LIGHT SOURCE EFFECTS
K. Forbus May 1977 27 p refs
(Contract N00014-75-C-0643)
(AD-A052309; AI-M-422) Avail: NTIS HC A03/MF A01 CSCL 06/6

The perception of surface luster in achromatic singleview images seems to depend on the existence of regions with source-like properties. These regions are due to the interaction of the specular component of the surface's reflectance and the illumination. Light source effects are broken down into three catagories according to gross aspects of the physical situation in which they occur, and criteria for detecting the regions they cause are suggested. Author (GRA)

N78-24935# Fondazione Ugo Bordoni, Rome (Italy).
CHROMATIC DELAY IN LIGHT EMITTING DIODES MEASUREMENTS AND THEORY
Paolo Spano 1977 5 p refs Presented at the 3d European Conf. on Opt. Commun., Monaco, 14-16 Sep. 1977
(FUB-10-1977) Avail: NTIS HC A02/MF A01

In order to investigate the effect of driving light emitting diodes on the phase shift of the optical spectrum, measurements of the phenomenon are presented together with a possible interpretation, the LED being driven with a radio frequency signal of 27 MHz superimposed on a dc bias. ESA

N78-24936# National Bureau of Standards, Washington, D. C.
SELF-STUDY MANUAL ON OPTICAL RADIATION MEASUREMENTS. PART 1: CONCEPTS, CHAPTERS 4 AND 5 Final Report
F. E. Nicodemus, ed. and Henry J. Kostkowski Feb. 1978 121 p refs
(PB-277176; TN-910-2-Pt-1) Avail: NTIS HC A06/MF A01 CSCL 20F

The following radiometric quantities are defined and discussed: radiant energy, radiant exposure, radiant fluence, radiant density, radiant intensity, radiant flus (surface) density, irradiance, radiant exitance, radiant fluence rate, radiant sterisent, as well as spectral radiant energy, and the other corresponding spectral quantities. Important interrelationships between the different quantities are also presented, particularly where they help to clarify their significance and the distinctions between them. Treatment of one of the most important interrelationships, the inverse-square law, also covers commonly used approximations involving actual (extended) sources and receivers. Author

N78-24937# Electricity Council Research Center, Capenhurst (England).
HUE DISCRIMINATION AND LIGHT SOURCES
P. R. Boyce and R. H. Simons (Thorn Lighting Ltd., Enfield, England) Aug. 1977 46 p refs
(PB-277680; ECRC/N-1081) Avail: NTIS HC A03/MF A01 CSCL 20F

Color matching and hue discrimination are important tasks in many industries. Eight experiments in hue discrimination are briefly described in which the effects of lamp type, illuminance and subject's age and experience on the performance of the Farnsworth-Munsell 100 hue test were examined. Statistical analysis showed that either the CIE Gamut area or the color rendering index of the lamp type could be used as an approximate predictor of the level of performance on the test, the larger the CIE gamut area or the higher the color rendering index, the better the performance. Compared to the effect of lamp type the influence of illuminance was small, the only significant effect being an imporvement in performance at higher illuminances for the older age group. Age itself had a large effect. The older age group consistently produced much worse performances than the young or middle age groups. Experience was not found to be a significant factor. Author

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N78-24938*# Stanford Univ., Calif. Inst. for Plasma Research.
DYNAMO ACTION IN A THIN SLAB
D. D. Barbosa May 1978 26 p refs
(Grant NGL-05-020-272; Contract N00014-75-C-0673)
(NASA-CR-157010; SU-IPR-742) Avail: NTIS HC A03/MF A01 CSCL 20I

The dynamo action produced by convection of a partially-ionized, electrically conducting gas in a magnetic field is considered using a model consisting of two thin, Cartesian unipolar inductors connected in a series by the magnetic field. The total current system generated by an arbitrary gas flow is computed for the case of a uniform magnetic field. For the case of a nonuniform field, only the field-aligned coupling current is computed. Application is made to the solar atmosphere. Author

N78-24939*# Massachusetts Inst. of Tech., Cambridge. Francis Bitter National Magnet Lab.
DESIGN OF A SUBMILLIMETER LASER THOMSON SCATTERING SYSTEM FOR MEASUREMENT OF ION TEMPERATURE IN SUMMA Final Report
Herman C. Praddaude and Paul Woskoboinikow Apr. 1978 164 p refs
(Grant NsG-3088)
(NASA-CR-2974) Avail: NTIS HC A08/MF A01 CSCL 20I

A thorough discussion of submillimeter laser Thomson scattering for the measurement of ion temperature in plasmas is presented. This technique is very promising and work is being actively pursued on the high power lasers and receivers necessary for its implementation. In this report we perform an overall system analysis of the Thomson scattering technique aimed to: (1) identify problem areas; (2) establish specifications for the main components of the apparatus; (3) study signal processing alternatives and identify the optimum signal handling procedure. Because of its importance for the successful implementation of this technique, we also review the work presently being carried out on the optically pumped submillimeter CH3F and D2O lasers. Author

N78-24940# Nagoya Univ. (Japan). Inst. of Plasma Physics.
TOKAMAK EXPERIMENTS ON JIPP T-2 WITH PULSED GAS INJECTION
K. Toi, S. Itoh, J. Fujita, K. Kadota, K. Kawahata, Y. Kawasumi, K. Matsuura, N. Noda, and S. Tanahashi Feb. 1978 42 p refs
(IPPJ-322) Avail: NTIS HC A03/MF A01

The confinement of Tokamak plasma was investigated in the wide range of electron density from 10 to 50 trillion/cu cm by using the pulsed gas injection. The gross energy confinement time increases with increase of electron density and reaches 14 msec. The averaged effective ionic charge derived from plasma conductivity is about 1 to 2 in the regime of small streaming parameter. The ratio of ion temperature to electron one is in the range greater than 0.5. This fact means that the ion energy confinement time is greater than the electron-ion energy relaxation time. Excessive injection of cold neutral gas excites m = 2 MHD oscillations. Much more gas injection leads to the remarkable cooling of plasma periphery and disruptive instabilities. These MHD oscillations and disruptive instabilities were suppressed by the heating of plasma periphery with the second rapid rise of plasma current. Author

N78-24941# Nagoya Univ. (Japan). Inst. of Plasma Physics.
APPLICATION OF LINEAR RESPONSE THEORY TO DIELECTRIC AND CONDUCTION PROBLEMS IN A TURBULENT PLASMA
Mitsuo Kono and Nobuo Yajima Mar. 1978 28 p refs
(IPPJ-325) Avail: NTIS HC A03/MF A01

The dielectric function in a turbulent plasma is derived based on the linear response theory, in which a summation of the infinite series is made in order to get the pair-correlational effects exactly. This infinite sum can be performed with the aid of diagram techniques and reproduces the dielectric function obtained before by Kono and Yajima. The complex conductivity is also derived by using a similar diagram technique and rightly agrees with that obtained kinetic-theoretically by Nishikawa and Ichikawa. Author

N78-24942# Nagoya Univ. (Japan). Inst. of Plasma Physics.
THERMAL-FLUX REDUCTION BY ELECTROMAGNETIC INSTABILITIES
T. Okada (Tokyo Univ. of Agr. and Tech.), T. Yabe (Tokyo Inst. of Tech.), and K. Niu (Tokyo Inst. of Tech.) Mar. 1978 25 p refs
(IPPJ-326) Avail: NTIS HC A02/MF A01

From a dispersion, linear growth rates of electromagnetic instabilities are obtained in an electron plasma whose velocity distribution function has a high-energy-tail part. The reduction in the thermal flux caused by these electromagnetic instabilities is derived by a quasilinear theory and the saturation level of instabilities is determined. Numerical simulations are carried out by using PIC method. Reduction rates in flux limited theory of thermal conduction predicted by the theory are found to be in good agreement with computer simulations. Author

N78-24943# Nagoya Univ. (Japan). Inst. of Plasma Physics.
MHD STABILITY OF RUNAWAY ELECTRON DISCHARGE IN TOKAMAKS
M. Wakatani Apr. 1978 15 p refs
(IPPJ-328) Avail: NTIS HC A02/MF A01

The influence of directed kinetic energy and anisotropic pressure associated with runaway electrons on toroidal stability properties was examined. A runaway electron current concentrating in the central region is shown to have stability effects on magnetohydrodynamic stability against kink and tearing modes, provided it is rigid and immobile. This supports a concept of axisymmetric toroidal plasma confined by a relativistic electron beam injection or another heating method. Author

N78-24944# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NUMERICAL ANALYSIS OF NONLINEAR COLLISIONAL DRIFT INSTABILITY
K. I. Nishi-Kawa, T. Hatori, and Y. Terashima Apr. 1978 36 p refs
(IPPJ-329) Avail: NTIS HC A03/MF A01

The nonlinear evolution of collisional drift wave instability is studied numerically. Model equations of quasilinear type are used which describe the modification of background density and the amplitude of unstable drift wave. Their solutions are classified according to the value of a parameter (n) which is proportional to the ratio of ion viscous damping to linear growth rate. In the vicinity of marginal stability, the unstable drift waves are shown to be saturated by flattening of the background density. An N decreases further, periodic and later aperiodic solutions are obtained. The wave associated diffusion coefficient is obtained numerically as a function of N and found to be much less than the usual estimate. Author

N78-24945# Naval Research Lab., Washington, D. C.
DENSITY SENSITIVE LINES FROM SELECTED MEMBERS OF THE SODIUM-LIKE ISOELECTRONIC SEQUENCE
Jack Davis and M. Blaha Dec. 1977 40 p refs
(Contract E(49-20)-1006)
(AD-A051300; AD-E000116) Avail: NTIS HC A03/MF A01 CSCL 20/9

Relative intensities of spectral lines in the sodium isoelectronic sequence are presented. Results are presented for ions of calcium, iron, zinc, krypton and molybdenum for transitions between the n = 3 and n = 4 levels. GRA

N78-24946# Naval Surface Weapons Center, White Oak, Md.
ELECTRIC CONDUCTIVITY IN A BEAM, PLASMA SYSTEM Final Report
Ronald L. Kligman 15 Sep. 1977 34 p refs
(AD-A052569; NSWC/WOL/TR-77-146) Avail: NTIS HC A03/MF A01 CSCL 20/9

The electric conductivity of a beam, plasma system may be suitably expressed as the Fourier transform of its velocity correlation function. A model Hamiltonian for the system is assumed leading to the time propagator. The beam is represented as a line current source and the plasma is taken to be collisionless. Author (GRA)

N78-24947# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
LATERAL BUCKLING AND VIBRATIONS OF SUPERCON-

DUCTING MAGNETIC FUSION REACTORS Progress Report, Oct. 1976 - May 1977
Francis C. Moon May 1977 24 p refs
(Contract EY-76-S-02-2780; Grant NSF ENG-76-23527)
(COO-2780-3) Avail: NTIS HC A02/MF A01

Experimental buckling was studied in a 16 coil superconducting torus which is a 1/75th model of an early experimental power reactor design. The colts in the experimental torus were designed to buckle below the normal transition current level. Up to 130 KA-turns were placed in the torus during these tests. The test results are described. ERA

N78-24948# Kanner (Leo) Associates, Redwood City, Calif.
INVESTIGATION OF PRESSURE BUILDUP IN A STATIONARY HELIUM DISCHARGE STABILIZED BY A MAGNETIC FIELD, THROUGH MAGNETIC MEASUREMENTS
O. Klueber [1977] 31 p Transl. into ENGLISH from Z. Naturforsch, v. 22, 1967 p 1599-1612
(LA-tr-77-9) Avail: NTIS HC A03/MF A01

The pressure buildup of a stationary linear discharge in the field of a cylindrical coil is investigated experimentally. For that purpose the magnetic flux of the inner magnetic field (i.e. generated by currents in the plasma) is measured by induction coils that are distributed over the length of the discharge tube and a consistent picture can be gained of the pressure buildup in this discharge. The pressure at the axis of the plasma column inside the field coil appears to be about one atmosphere greater than the pressure in the neutral gas envelope and in that part of the discharge which is outside the field coil. This pressure buildup is to be traced back to the already known effect of ambipolar diffusion vertical to a magnetic field and also to the NERNST-effect. ERA

N78-24949# Princeton Univ., N. J.
COUPLING OF SLOW AND FAST WAVES TO PLASMAS NEAR THE LOWER HYBRID FREQUENCY
R. L. Berger, F. W. Perkins, and F. Troyon Aug. 1977 56 p refs
(Contract EY-76-C-02-3073)
(PPL-1366) Avail: NTIS HC A04/MF A01

Lower hybrid frequency heating relies on the efficient coupling of vacuum radiation to plasma waves that propagate across the field lines and heat the plasma core. Penetration through the plasma surface to high densities imposes a minimum value of N/sub parallel/, the parallel index of refraction. The evanescent layer of low density is very thin for the slow wave, but is much larger for the fast wave, especially for large Tokamaks, and thus, short wavelengths will not penetrate. A new effect proportional to the product of the density gradient and the azimuthal wavenumber, can either reduce or increase the evanescence for the fast wave. For hot plasmas, linear electron. Landau damping imposes an upper limit on N/sub parallel/ so that only a narrow spectrum of waves can penetrate. The coupling efficiency is obtained for plane waves incident on the plasma and is found to depend weakly on the density gradient scale length. ERA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N78-24950* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPARATUS FOR USE IN EXAMINING THE LATTICE OF A SEMICONDUCTOR WAFER BY X-RAY DIFFRACTION Patent
Donald L. Parker (Texas A and M Univ.) and Wilbur A. Porter, inventor (to NASA) (Texas A and M Univ.) Issued 7 Mar. 1978 5 p Filed 20 Sep. 1976 Supersedes N76-32029 (14-22, p 2938) Sponsored by NASA
(NASA-Case-MFS-23315-1; US-Patent-4,078,175; US-Patent-Appl-SN-724874; US-Patent-Class-250-277CH; US-Patent-Class-250-280) Avail: US Patent Office CSCL 20L

An improved apparatus for examining the crystal lattice of a semiconductor wafer utilizing X-ray diffraction techniques was presented. The apparatus is employed in a method which includes the step of recording the image of a wafer supported in a bent configuration conforming to a compound curve, produced through the use of a vacuum chuck provided for an X-ray camera. The entire surface thereof is illuminated simultaneously by a beam of incident X-rays which are projected from a distant point-source and satisfy conditions of the Bragg Law for all points on the surface of the water.
Official Gazette of the U.S. Patent Office

N78-24951*# Cornell Univ., Ithaca, N. Y. Lab. of Atomic and Solid State Physics.
ON THE GROUND STATE OF METALLIC HYDROGEN
Sudip Chakravarty and N. W. Ashcroft [1978] 29 p refs
(Grant NGR-33-010-188)
(NASA-CR-157162) Avail: NTIS HC A03/MF A01 CSCL 20L

A proposed liquid ground state of metallic hydrogen at zero temperature is explored and a variational upper bound to the ground state energy is calculated. The possibility that the metallic hydrogen is a liquid around the metastable point (rs = 1.64) cannot be ruled out. This conclusion crucially hinges on the contribution to the energy arising from the third order in the electron-proton interaction which is shown here to be more significant in the liquid phase than in crystals. Author

N78-24952*# National Aeronautics and Space Administration. Pasadena Office, Calif.
A METHOD OF GROWING A RIBBON CRYSTAL PARTICULARLY SUITED FOR FACILITATING AUTOMATED CONTROL OF RIBBON WIDTH Patent Application
Theodore F. Ciszek, inventor (to NASA) (IBM, Hopewell Junction, N.Y.) Filed 28 Apr. 1978 18 p
(Contracts NAS7-100; JPL-954144)
(NASA-Case-NPO-14295-1; US-Patent-Appl-SN-901055) Avail: NTIS HC A02/MF A01 CSCL 20L

A method of growing a ribbon crystal is reported wherein a meniscus of molten semiconductor material attached to vertical movable seed is lifted at a rate substantially equal to the rate at which the meniscus freezes. The method is characterized by the steps of continuously sensing the brightness of the growth region of the ribbon in selected areas across the width for detecting changes in brightness intensity. Modifying the temperature of the meniscus and the pulling speed in response to changes detected in the intensity controls ribbon geometry. NASA

N78-24953# Nagoya Univ. (Japan). Inst. of Plasma Physics.
VOID LATTICE FORMATION: SPINODAL DECOMPOSITION OF VACANCIES
Masatoshi Imada Mar. 1978 23 p refs
(IPPJ-327) Avail: NTIS HC A02/MF A01

Superlattices of voids form in various metallic crystals and alloys under conditions of heavy radiation damage near the threshold temperature of void formation. The mechanism of the void lattice formation is considered as a spinodal decomposition, of vacancies. In the region of the spinodal decomposition, the void lattice constant is determined by estimating the periodicity growing in the spinodal decomposition. The void radius in the void lattice should be determined from the static stability.
Author

N78-24954# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
MEASUREMENTS ON THE 3D 5/2 TO 2P 3/2 TRANSFERS IN MUONIC SILICON BY CRYSTAL SPECTROMETER Ph.D. Thesis [MESSUNG DES 3D 5/2 - 2P 3/2 UEBERGANGES IN MYONISCHEM SILIZIUM MIT EINEM KRISTALLSPEKTROMETER]
Ralph Eichler 1976 116 p refs In GERMAN
(Diss-5791) Avail: NTIS HC A06/MF A01

The energy spectrum of the muonic silicon 3d to 2p transfer was determined by comparing the measured wavelength of 16. 13391 + or - 0. 000502 pm with the predicted wavelength of 16. 182372 + or - 0. 000114 pm. A quantum electrodynamic correction to the Dirac theory for muon atoms, and the assumption that anomalous interchange effects are absent, produced an exact mass determination for the negatively charged muon. Mass

comparison with the positively charged muon gives a relative mass difference of 63 + or - 32 ppm comparative to the zero in the CPT theorem. Transl. by G.G.

N78-24955# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
CRYSTALLOGRAPHIC STUDIES ON PHASE TRANSFORMATIONS IN (NH4)2H3IO6 AND Ag2H3IO6 Ph.D. Thesis [KRISTALLOGRAPHISCHE UTERSUCHUNGEN DER PHASENUMWANDLUNGEN IN (NH4)2H3IO6 UND AG2-H3IO6]
Andreas Rueegg 1977 100 p refs In GERMAN; ENGLISH summary
(Diss-5908) Avail: NTIS HC A05/MF A01

The structure of (NH4)2HeIO6 (APJ) was determined by neutron diffraction. The ability of the ammonium ion to form hydrogen bonds accounts for the differences to the isomorphous Ag2H3IO6 (SPJ). The structures of both compounds below the transition temperature were determined by X-ray diffraction. The phase transition in APJ is of the antiferrodistortive-ferrielectric type and leads to a fourfold unit cell and the space group R3. In SPJ, an antiferrodistortive-antiferroelectric transition results in a fourfold unit cell and the space group PI. Proton ordering follows the Bernal-Fowler rules in both cases. The magnitudes and directions of the shifts of the silver atoms in the low temperature phase of SPJ suggest a model of the intermediate phase. The different transition temperatures of APJ and SPJ can be explained by the different spacing of the two potential wells on the hydrogen bond. Author

N78-24956# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
SPIN WAVES IN ONE-DIMENSIONAL ANTIFERROMAGNETS CsNiCl3 AND CsCoCl3 Ph.D. Thesis [SPINWELLEN IN DEN EINDIMENSIONALEN ANTIFERROMAGNETEN CsNiCl3 UND CsCoCl3]
Tellenbach Ulrich 1977 51 p refs In GERMAN; ENGLISH summary
(Diss-5966) Avail: NTIS HC A04/MF A01

A method is developed for calculating the density of states of a disordered, ferromagnetic chain, and various applications are discussed. A rigorous derivation of the dispersion curve for the anisotropic linear magnetic chain was developed. The magnetic excitations of CSNiCl3 sub n (T=4.8 K) and CsCoCl3 sub n (T=21.5 K) by inelastic neutron scattering were studied. Experimental results confirm that these compounds behave as one-dimensional, anisotropic antiferromagnets. Author

N78-24957# Council for Scientific and Industrial Research, Pretoria (South Africa). Foreign Language Service.
THE GROWTH OF TUNGSTEN SINGLE CRYSTALS FROM THE GAS PHASE DURING CHEMICAL REACTIONS
G. Weise and G. Owsian 1977 23 p refs Transl. into ENGLISH from J. Less-Common Metals (Netherlands), no. 22, 1970 p 99-116
(CSIR-Trans-1379) Avail: NTIS HC A02/MF A01

A quartz apparatus with a high vacuum system was used to determine the possibility of growing homogeneous (layers free of imperfections) tungsten single crystals by the thermal dissociation of tungsten hexachloride. The growth forms obtained show characteristic differences in the nature and number of boundary faces in relation to the orientation of the rod axis and growth conditions. Optical and electron microscopic observations of the morphological phenomenon and X-ray topological investigations of the real structure of the crystals are discussed and illustrated. Author

N78-24958*# California Univ., Davis.
ELECTRONIC AND OPTICAL PROPERTIES OF SbSBr, SbSI AND SbSeI Interim Report
J. F. Alward, C. Y. Fong, M. El-Batanouny, and F. Wooten Oct. 1977 15 p refs
(Contract F49620-76-C-0016; NCA2-OR180-502)
(NASA-CR-156929; AD-A051990; AFOSR-78-0405TR) Avail: NTIS HC A02/MF A01 CSCL 20/12

Electronic band structures of the ternary semiconductors SbSBr, and SbSeI have been obtained by using the empirical pseudopotential method (EPM) to fit our measured optical reflectivity data and earlier gap measurements. An SbSI band structure has been determined by fitting to earlier reflectivity and Raman spectroscopic data, and the results agree better with the data than do the results of an earlier preliminary EPM calculation. Above the SbSI conduction band minimum are secondary minima located midway along the Gamma 2 and Gamma X symmetry lines. These minima may in part be responsible for the observed microwave oscillation (Gunn effect) in this crystal. Similar minima in SbSBr and SbSeI are reported, suggesting these crystals might also show microwave properties. The total densities of states are presented. Author (GRA)

N78-24959# Stanford Univ., Calif. Center for Materials Research.
LONG RANGE MATERIALS RESEARCH. DEVELOPMENT OF ELEVATED TEMPERATURE ELECTROCRYSTALLIZATION TECHNIQUES Final Report, 1 Jun. 1975 - 31 Dec. 1977
Robert A. Huggins, D. Elwell, R. S. Feigelson, and R. C. DeMattei Feb. 1978 53 p refs
(Contract N00014-75-C-1171; ARPA Order 3018)
(AD-A051502; CMR-78-4) Avail: NTIS HC A04/MF A01 CSCL 20/2

The aim of this program was to develop the techniques and understanding necessary for the growth of films or single crystals of a variety of materials by molten salt electrocrystallization. The conditions for stable growth of materials by this technique have been explored both theoretically and experimentally. The theoretical studies have shown the importance of a high solute concentration, the potential gradient at the crystal-solution interface and of a material parameter which we have termed the growth rate constant. The current density, which determines the rate of deposition, is also a crucial parameter in many experiments and a value in the range 10-50 milli-Angstrom/sq cm must not be exceeded if stable growth is to occur. GRA

N78-24960# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH, 1977: 4 Quarterly Technical Summary Report, 1 Aug. - 31 Oct. 1977
Alan L. McWhorter 15 Nov. 1977 74 p refs
(Contract F19628-78-C-0002)
(AD-A052463; ESD-TR-77-294) Avail: NTIS HC A04/MF A01 CSCL 09/3

This report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 August through 31 October 1977. The topics covered are Solid State Device Research, Quantum Electronics, Materials Research, Microelectronics, and Surface-Wave Technology. Funding is primarily provided by the Air Force, with additional support provided by the Army, ARPA, NSF, and DOE.
Author (GRA)

N78-24961# General Electric Co., Schenectady, N. Y. Corporate Research and Development.
FLUX PINNING AND CRITICAL CURRENTS IN A-15 SUPERCONDUCTORS Final Scientific Report, 1 Jan. 1975 - 31 Dec. 1977
J. D. Livingston and R. A. Sigsbee Feb. 1978 17 p
(Contract F44620-75-C-0044; AF Proj. 2306)
(AD-A052618; SRD-78-028; AFOSR-78-0502TR) Avail: NTIS HC A02/MF A01 CSCL 20/3

The relationship between processing, microstructure, and properties was studied for A-15 compounds in multifilamentary composites produced by solid-state diffusion and in thin-film samples produced by vapor deposition. Grain sizes of A-15 superconducting compounds were measured by transmission electron microscopy of multifilamentary composites reacted at various temperatures. Critical current densities at 4.2 K and fields up to 6 T were found to be similar for niobium-tin, vanadium-gallium, and vanadium-silicon of the same grain size. Study of the Cu-V-Si phase diagram led to the production of improved multifilamentary vanadium-silicon conductors. The effects of various alloying elements on A-15 layers produced by solid-state diffusion were studied. The most promising new observation was that tantalum can be incorporated into niobium-tin reaction layers, leading to an enhancement of critical currents at high fields. The critical temperature of vapor-deposited, niobium-germanium films has been studied as a function of deposition rates, flux

stoichiometry, substrate temperature, and, especially, gas composition. Introduction of controlled levels of oxygen has been found to expand the range of Nb-Ge flux ratios which yield high critical temperatures. Author (GRA)

N78-24962# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
EVALUATION OF SULFOSALTS Final Technical Report, 15 Apr. 1976 - 15 Oct. 1977
T. J. Isaacs, R. W. Weinert, J. Murphy, and J. P. McHugh Griffiss AFB, N. Y. RADC Oct. 1977 88 p refs
(Contract F19628-76-C-0158)
(AD-A052356; RADC-TR-77-367) Avail: NTIS HC A05/MF A01 CSCL 09/1

The program had two principal objectives, one of which was to determine the optimum conditions for fabrication of reproducible, high quality crystals of TI3 S4, and possibly other members of the TI3BX4 family of materials. The other was to determine directions in these crystals having zero temperature coefficients of delay (ZTCD) for surface acoustic waves, and to assess which of these directions possesses the best combination of velocity, k to the 2d power, and power flow angle for device applications. New determinations of physical parameters (attenuation) velocities, k to the 2d power, were to be made on improved crystals. In addition, the effects of wider temperature ranges and higher order temperature coefficients of velocity were to be examined. Hall measurements also were to be made. A bandpass filter was to be fabricated to demonstrate the applicability of these materials for surface-wave devices. Author (GRA)

N78-24963# United Technologies Research Center, East Hartford, Conn.
TWO DIMENSIONAL NUMERICAL SIMULATION OF NEGATIVE DIFFERENTIAL MOBILITY SEMICONDUCTING DEVICES
T. M. McHugh and H. L. Grubin Dec. 1977 15 p refs Presented at the 1976 Summer Computer Simulation Conf., Washington, D. C., Jul. 1976
(Contract N00014-74-C-0237)
(AD-A052419; UTRC/R77-921818-3) Avail: NTIS HC A02/MF A01 CSCL 20/12

A numerical simulation in two spatial dimensions of negative differential mobility semiconducting devices is described. The simulation models time dependent operation of two or three terminal devices in an external circuit is presented. The mathematical model of the semiconductor consists of a set of nonlinear second-order partial differential equations which are solved on a rectangular mesh using explicit finite difference techniques. The external circuit is modeled using lumped linear elements and the resulting equations are solved using implicit techniques. The external circuit equations are coupled to the semiconductor equations by the current flow and potential at the device terminals. The solution of the resulting time dependent boundary value problem is a feature of the simulation which permits more realistic numerical analysis of NDM devices than was previously possible. The simulation is implemented using interactive computer graphics. As the solution evolves, displays of the potential, charge density and current flow in the semiconductor are available via a computer graphic terminal. Sample results of simulations of a negative differential mobility field effect transistor are presented. Author (GRA)

N78-24964# Massachusetts Inst. of Tech., Cambridge.
LIQUID PHASE EPITAXY OF GaAsSb ON InP SUBSTRATES Final Report, 1 Oct. - 31 Dec. 1976
Clifton G. Fonstad 31 Jul. 1977 38 p refs
(Contract N00019-76-C-0653)
(AD-A052291) Avail: NTIS HC A03/MF A01 CSCL 09/1

The Ga-As-Sb system is shown to exhibit immiscibility-like behavior, i. e., certain solid compositions do not exist, for growth from ternary melts in spite of the fact that the pseudobinary system is fully miscible. The ternary melt miscibility gap narrows with increasing growth temperature and disappears above a certain temperature but even then the solid composition remains a very sensitive function of the growth temperature. GRA

N78-24965# Battelle Columbus Labs., Ohio.
PARAMETER-FREE ELECTRONIC CALCULATIONS IN CRYSTALS AND THIN FILMS Final Report
R. E. Euwema and I. Shavitt 24 Feb. 1978 61 p refs
(Contract F44620-76-C-0026)
(AD-A052585; BATT-G-6329; AFOSR-78-0492TR) Avail: NTIS HC A04/MF A01 CSCL 20/12

Three major sets of computer programs have been extensively modified and extended. These programs are a molecular code for finite clusters of atoms with the coding optimized for clusters with cubic point group symmetry, a thin film code for several interacting infinite two-dimensional sheets of atoms, and a crystal code for an infinite number of atoms with cubic symmetry. These programs provide a predictive capability for clusters and platelets of atoms, surfaces and perfect crystals through first-principles calculations at the Unrestricted Hartree-Fock level. These programs have been provided to and used by several USAF personnel. Author (GRA)

N78-24966# Harry Diamond Labs., Adelphi, Md.
THE MADELUNG ENERGY FOR THE STRUCTURE Y/2-HfS5
Clyde A. Morrison Feb. 1978 15 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A052429; HDL-TR-1842) Avail: NTIS HC A03/MF A01 CSCL 07/2

In the theory of the cohesive energy of ionic or nearly ionic crystals, the electrostatic energy, or Madelung energy, is important. Generally, the electrostatic cohesive force persists, despite the presence of strong repulsive forces of ions of similar charge among the constituent ions. Because of the magnitude of the Madelung energy, it dominates the energy of formation of most ionic solids and therefore is of interest to chemists who are attempting to grow single crystals larger than microscopic powders. The amount of literature on the various methods of calculating the electrostatic energy of an ionic solid is absolutely overwhelming, but a methodical compilation of the results of these calculations does not seem to exist. Practically every textbook of physical chemistry or solid-state physics lists a number of references to original papers on this subject. Consequently, we list here only references pertinent to the problem at hand: the calculation of the Madelung energy for Y/2HfS5. The technique used here is elementary; however, it seems not to be in any of the textbooks. GRA

N78-24967 National Technical Information Service, Springfield, Va.
GALLIUM ARSENIDE EPITAXIAL GROWTH, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1975
Mona F. Smith Mar. 1978 185 p
(NTIS/PS-78/0226/7) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 20L

Research abstracts on GaAs epitaxial growth in liquid and vapor phases are included in this bibliography. Techniques, tests, physical properties, crystal structure, and doping are described. Gallium arsenide use in optical modulators, fiber optics, semiconductor diodes, and microwave equipment is also studied. GRA

N78-24968 National Technical Information Service, Springfield, Va.
GALLIUM ARSENIDE EPITAXIAL GROWTH, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Mar. 1978
Mona F. Smith Mar. 1978 129 p Supersedes NTIS/PS-77/0139 and NTIS/PS-76/0102
(NTIS/PS-78/0227/5; NTIS/PS-77/0139; NTIS/PS-76/0102) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 20L

Research abstracts on GaAs epitaxial growth in liquid and vapor phases are included in this bibliography. Techniques, tests, physical properties, crystal structure, and doping are described. Gallium arsenide use in optical modulators, fiber optics, semiconductor diodes and microwave equipment is cited. GRA

N78-24969 National Technical Information Service, Springfield, Va.
GALLIUM ARSENIDE EPITAXIAL GROWTH, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1976 - Mar. 1978
Mona F. Smith Mar. 1978 231 p Supersedes NTIS/PS-77/0141

(NTIS/PS-78/0228/3; NTIS/PS-77/0141) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 20L

Citations from worldwide research journals on gallium arsenide vapor and liquid phase and molecular beam epitaxial growth are presented. Crystal structure, physical, and electrical properties of epitaxial gallium arsenide are included, as are studies on doping effects, defects, and semiconductor devices. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N78-24970# Eidgenoessische Technische Hochschule, Zurich (Switzerland).

OPERATOR FORMALISM FOR THE HIGH ENERGY LIMIT IN FIELD THEORY MODELS Ph.D. Thesis [OPERATORFORMALISMUS FUER DEN HOCHENERGIELIMES VON FELD-THEORETISCHEN MODELLEN]

Werner Wetzel 1976 68 p refs In GERMAN

(Diss-5660) Avail: NTIS HC A04/MF A01

Operator formalisms for developing high energy scattering in field theoretical models are studied. Considered are: Scattering of spin 1/2 and spin 0 fields in a vector potential, minimal spin field coupling to a substantial vector field and eigeninteraction in the scalar field, interchange relations on light cone surfaces and their application to interacting fields, and an operator for cluster-cluster scattering that uses individual Lorentz transformations to illustrate the acceleration of both clusters in opposite directions. Transl. by G.G.

N78-24971# Laboratoire de Physique Theorique et Particules Elementaires, Orsay (France).

QUANTUM NONSEPARABILITY: HOW THE PROBLEM EVOLVED FROM EINSTEIN'S TIME TO OURS

Bernard Despagnat Dec. 1976 19 p refs Presented at the Conf. Fifty Years of Quantum Mech., Erice, Italy, 5 Aug. 1976

(LPTPE-76/29) Avail: NTIS HC A02/MF A01

The quantum nonseparability problem is reviewed. The philosophical implications of the nonseparability appearing in various formalizations of quantum theory are discussed with the aim of clarifying the reality of nonseparability. The role of the Bell inequalities in promoting understanding of the problem is stressed and a list of experiments to verify them is given. It is emphasized that such experiments constitute tests of quantum mechanics at macroscopic distances and that their results have a direct bearing on the nature of the Einstein-Podolsky-Rosen problem. It is concluded that nonseparability is real and at present scientifically established. ESA

N78-24972# National Technical Information Service, Springfield, Va.

RELATIVITY THEORY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - Feb. 1978

George W. Reimherr Mar. 1978 178 p Supersedes NTIS/PS-77/0201; NTIS/PS-76/0135; NTIS/PS-75/230

(NTIS/PS-78/0253; NTIS/PS-77/0201; NTIS/PS-76/0135; NTIS/PS-75/230) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 08F

Research studies are presented on special and general relativity. Gravitational theory, field theory, and space-time studies are included, as are studies involving the Minkowski space, the Schrodinger equations, the Dirac equations, and the Lorentz transformations. Author

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N78-24973# Hawaii Univ., Honolulu. Sea Grant Program.

UNIVERSITY OF HAWAII MARINE OPTION PROGRAM Annual Report, 1976 - 1977

John J. Mcmahon Dec. 1977 38 p refs

(Grants NOAA-04-5-158-44026; NOAA-04-6-158-44114)

(PB-278260; UNIHI-SEAGRANT-MR-78-02; NOAA-78022402) Avail: NTIS HC A03/MF A01 CSCL 05B

During fiscal year 1976-77, the Marine Option Program continued to grow: new marine courses were developed; the Ninth Legislature of the State of Hawaii examined the Marine Option Program and was favorably impressed; and a fourth campus in the UH system received federal assistance in starting a Marine Option Program. MOP students again received state and federal funding for projects valuable to the state. MOP students contributed their time, energy, and talents in working with marine professionals towards solutions for marine related problems throughout the state. Author

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N78-24974*# Barry (Theodore) and Associates, Los Angeles, Calif.

SAMICS SUPPORT STUDY. VOLUME 1: COST ACCOUNT CATALOG Final Report

Sep. 1977 94 p refs Sponsored in part by ERDA Prepared for JPL

(Contracts NAS7-100; JPL-954800)

(NASA-CR-157131; ERDA/JPL-954800-77/2.1) Avail: NTIS HC A04/MF A01 CSCL 05A

The Jet Propulsion Laboratory (JPL) is examining the feasibility of a new industry to produce photovoltaic solar energy collectors similar to those used on spacecraft. To do this, a standardized costing procedure was developed. The Solar Array Manufacturing Industry Costing Standards (SAMICS) support study supplies the following information: (1) SAMICS critique; (2) Standard data base--cost account structure, expense item costs, inflation rates, indirect requirements relationships, and standard financial parameter values; (3) Facilities capital cost estimating relationships; (4) Conceptual plant designs; (5) Construction lead times; (6) Production start-up times; (7) Manufacturing price estimates. Author

N78-24975# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).

SELECTION OF THE BEST FROM A SEQUENCE OF OPTIONS WITH IMPERFECT INFORMATION

T. J. Stewart Jul. 1977 21 p refs

(CSIR-SR-WISK-267; ISBN-0-7988-1159-5) Avail: NTIS HC A03/MF A01

A form of sequential decision problem is introduced in which options are presented in a sequence (as in the secretary problem) but in which the value of each option has to be inferred from experiments. Decisions have thus to be made concerning both the acceptance or rejection of each option and the degree of experimentation. General properties of the optimal policy are derived and a solution in a special case is obtained in principle. On the basis of these results, certain possible approximations to the optimal policy are suggested. Author

N78-24976# Arinc Research Corp., Santa Ana, Calif.

MISSILE-X PROGRAM LOGISTIC ELEMENT MANAGEMENT PLAN FOR SUPPORT FACILITIES LEM

A. N. Winter and A. J. Fremer 22 Aug. 1977 32 p

(Contract F04606-76-A-0087)

(AD-A052280; W77-1953-TN09) Avail: NTIS HC A03/MF A01 CSCL 15/5

This Support Facilities Logistic Element Management Plan is one of twelve plans supplementing the guidance and direction for the Integrated Logistic Support (ILS) program as delineated in the Missile-X Integrated Logistic Support Plan (ILSP). Whereas the ILSP provides general guidance and direction for integrating all logistic elements into the overall program requirements, this

plan treats the specific actions, milestones, and coordination efforts of the Logistic Element Manager for Support Facilities (SF-LEM). It has been written to assist the SF-LEM in fulfilling his responsibilities toward achieving the ILS objectives of the MX Program. GRA

N78-24977# Arinc Research Corp., Santa Ana, Calif.
MISSILE-X PROGRAM LOGISTIC ELEMENT MANAGEMENT PLAN FOR RELIABILITY INTERFACE LEM
A. N. Winter and A. J. Fremer 15 Aug. 1977 33 p
(Contract F04606-76-A-0087)
(AD-A052250; W77-1953-TN04) Avail: NTIS HC A03/MF A01 CSCL 15/5

This Reliability Interface Logistic Element Management Plan is one of twelve plans supplementing the guidance and direction for the Integrated Logistic Support (ILS) program as delineated in the Missile-X Integrated Logistic Support Plan (ILSP). Whereas the ILSP provides general guidance and direction for integrating all logistic elements into the overall program requirements, this plan treats the specific actions, milestones, and coordination efforts of the Logistic Element Manager for the Reliability Interface. It has been written to assist him in fulfilling his responsibilities toward achieving the ILS objectives of the MX Program. GRA

N78-24978# Arinc Research Corp., Santa Ana, Calif.
MISSILE-X PROGRAM LOGISTIC ELEMENT MANAGEMENT PLAN FOR SUPPORT AND TEST EQUIPMENT LEM
A. N. Winter and A. J. Fremer 15 Aug. 1977 35 p
(Contract F04606-76-A-0087)
(AD-A052249; W77-1953-TN06) Avail: NTIS HC A03/MF A01 CSCL 15/5

This Support and Test Equipment Logistic Element Management Plan is one of twelve plans supplementing the guidance and direction for the Integrated Logistic Support (ILS) program as delineated in the Missile-X Integrated Logistic Support Plan Logistic elements into the overall program requirements. This plan treats the specific actions, milestones, and coordination efforts of the Logistic Element Manager for Support and Test Equipment (SE-LEM). It has been written to assist him in fulfilling his responsibilities toward achieving the ILS objectives of the MX Program. GRA

N78-24979# Arinc Research Corp., Santa Ana, Calif.
MISSILE-X PROGRAM LOGISTIC ELEMENT MANAGEMENT PLAN FOR MAINTENANCE PLANNING LEM
A. N. Winter and A. J. Eremer 22 Aug. 1977 35 p
(Contract F04606-76-A-0087)
(AD-A052279; W77-1953-TN12) Avail: NTIS HC A03/MF A01 CSCL 15/5

This Maintenance Planning Logistic Element Management Plan is one of twelve plans supplementing the guidance and direction for the Integrated Logistic Support (ILS) program as delineated in the Missile-X Integrated Logistic Support Plan (ILSP). Whereas the ILSP provides general guidance and direction for integrating all logistic elements into the overall program requirements, this plan treats the specific actions, milestones, and coordination efforts of the Logistic Element Manager for Maintenance Planning (MP-LEM). It has been written to assist the MP-LEM in fulfilling his responsibilities toward achieving the ILS objectives of the MX Program. The majority of information contained in Sections 1 through 4 herein is common to all plans. Sections 5 and 6 present information pertinent to the MP-LEM's efforts. Author (GRA)

N78-24980# Defense Systems Management School, Fort Belvoir, Va.
THE AFCMD SUBCONTRACT MANAGEMENT FUNCTION OR WHAT AN AFPRO SUBCONTRACT MANAGEMENT FUNCTION CAN DO FOR THE PROGRAM MANAGER
Roger S. Alexander Nov. 1977 45 p refs
(AD-A052390) Avail: NTIS HC A03/MF A01 CSCL 05/1

The purpose of the study project was to examine an approach to subcontract management being utilized by the Air Force Contract Management Division (AFCMD) from the perspective of what that approach could do for the buying agencies. The report initially reviews the events that led to the establishment of the subcontract Management (SM) function within AFCMD. It examines its organizations at Air Force Plant Representative Office (AFPRO) level and then explores the responsibilities of the SM function. The major responsibilities covered are the evaluation of the contractor's procurement system using the AFCMD Contractor Management System Evaluation Program (CMSEP) and tasks performed in direct support of buying agency. The report then reviews the future outlook and concludes with recommendations on how the buying agencies can take advantage of the SM services. Author (GRA)

N78-24981# Defense Systems Management School, Fort Belvoir, Va.
A NEW, INTEGRATED APPROACH TO ARMY OPERATIONAL TESTING AND EVALUATION
Freeman Gordon Lee 4 Nov. 1977 84 p refs
(AD-A052391) Avail: NTIS HC A05/MF A01 CSCL 05/1

An approach is developed to evaluate operational effectiveness and military utility for operational test and evaluation. The technique is applicable to many areas where the systems: engineering approach involves both quantitative and subjective elements. Operational test organizational interactions are given in Section 4. A model is developed in Section 5. Appendix B contains a technique to determine the operational effectiveness and military utility. Appendix C outlines the Delphi technique and Appendix D the application of utility theory to the problem of quantifying subjective information. Author (GRA)

N78-24982# Defense Systems Management School, Fort Belvoir, Va.
A STUDY OF USAF TEST AND EVALUATION POLICY
David Couter Kessler Nov. 1977 72 p refs
(AD-A052392) Avail: NTIS HC A04/MF A01 CSCL 05/1

The purpose of this report was to study the Air Staff effort and rationale used in revising the current AFR 80-14, Test and Evaluation, and AFR 23-36, Air Force Test and Evaluation Center, and to compare these regulations with the recent changes to DoD policy. GRA

N78-24983# Defense Systems Management School, Fort Belvoir, Va.
CONTRACTOR TESTING AND THE ARMY TEST AND EVALUATION MASER PLAN FOR FULL SCALE ENGINEERING DEVELOPMENT
Larry H. Johnson Nov. 1977 43 p refs
(AD-A052393) Avail: NTIS HC A03/MF A01 CSCL 05/1

Previous experience in the materiel acquisition process has shown that development of a master test plan for research and development poses many challenges. Because of general type guidance in RFP's and general type responses in contract proposals, a bilateral communications problem arises and the test program may or may not satisfy government requirements. Contractor testing plays a major role in the total test program and results of contractor tests must be utilized by government evaluators to satisfy independent government test objectives. If the contractor test program proves inadequate for government needs, the test program must be modified with minimum impact on cost and schedule. Herein lies the problem. The inherent problems related to developing a master plan through the RFP/proposal evaluation/contract initiation process are examined and recommendations for improving the process are offered. Author (GRA)

N78-24984# Defense Systems Management School, Fort Belvoir, Va.
RISK AVERSION VS. TECHNOLOGY IMPLEMENTATION
Michael H. Hersh Nov. 1977 31 p refs
(AD-A052386) Avail: NTIS HC A03/MF A01 CSCL 05/1

This report examines the key factors that inhibit the introduction of new technology into ongoing weapon systems. The effect of program manager (PM) risk aversion on this inhibition is evaluated. Factors causing PM risk aversion, including Department of Defense and Navy policies and procedures are considered. Results indicate major contributors to PM risk aversion include: risks taken that backfired, schedule pressure, program maturity, PM's relative loyalty to self, program, and service, inadequate methods of measuring risk and inability to hedge or insure risk. Forces that keep new technology out of ongoing programs include cost constraints, risk averse PMs, and on rare occasion, higher level authority. Author (GRA)

N78-24985# Defense Systems Management School, Fort Belvoir, Va.

AN OUTLOOK ON FUTURE WEAPON SYSTEMS ACQUISITION

J. Alan Higgins 1 Nov. 1977 65 p refs

(AD-A052385) Avail: NTIS HC A04/MF A01 CSCL 05/1

The subject of future weapons systems acquisition is discussed in this learning paper. Considerations for the threat, technology, economic trends and the competition for resources are included. Prospects for reducing acquisition costs are considered and alternatives for planning, programming and budgeting are discussed. The summary concludes that the outlook for future major weapon systems procurements is not favorable.

Author (GRA)

N78-24986# Defense Systems Management School, Fort Belvoir, Va.

FINANCIAL MANAGEMENT AS PRACTICED BY THE AIR FORCE HIGH ENERGY LASER PROGRAM

Jerome Thomas Janicke Nov. 1977 41 p

(AD-A052380) Avail: NTIS HC A03/MF A01 CSCL 05/1

This presentation discusses the budget execution in an Advanced Development program, the Air Force High Energy Laser Program. The discussion centers on three areas, the funds management of the total program allotment for a given fiscal year, establishment of the program funding structure, and the evolution of the internal funds management of this particular program. The first section addresses the difficulty associated with tracking the financing requirements for a most dynamic Advanced Development program. The unique profile of required funds versus available funds is shown. The discussion, then, centers on the management actions that provide the best technical achievement in a restricted funding environment. The funding structure section discusses the importance of financial interface between the program office and the finance and accounting system and the importance of one reporting system throughout the Department of Defense. The last section addresses the selling of funds management, to the technical management, the handling of internal budget reviews, the documentation of these reviews, and the payoffs. GRA

N78-24987# Defense Systems Management School, Fort Belvoir, Va.

MANAGEMENT INFORMATION SYSTEMS AND THE COMPUTER IN THE DEFENSE ACQUISITION PROGRAM OFFICE

Stuart N. Goodman Dec. 1977 38 p refs

(AD-A052375) Avail: NTIS HC A03/MF A01 CSCL 05/1

This report examines the role that computerized management information systems play in the decision making process in management organizations and in Department of Defense Program Offices for acquisitions in particular. A management information system is defined, and the need for information is discussed. The values and limitations of an MIS in the decision making process are presented. The MIS should not be considered as a decision making device, but only as an aid in helping management make the decisions. Before the MIS can be used to its maximum potential the manager must know what his specific information needs are. Information on the implementation of an MIS, and several examples of possible applications in a program office are presented. Author (GRA)

N78-24988# Defense Systems Management School, Fort Belvoir, Va.

THE CONTRACTING OFFICER AND THE PROGRAM MANAGER: AUTHORITIES, RESPONSIBILITIES AND RELATIONSHIPS WITHIN THE NAVY WEAPON SYSTEM ACQUISITION MANAGEMENT ARENA

Robert Allen Forney Nov. 1977 33 p refs

(AD-A052377) Avail: NTIS HC A03/MF A01 CSCL 05/1

The purpose of this research effort has been to investigate the relationship which exists between the Contracting Officer and the Program Manager. The scope of the effort was necessarily restricted to an examination of that relationship as found at Naval Sea Systems Command Headquarters, Washington D.C. in order to make the effort more manageable. In order to achieve the stated goals, a brief examination of the authorities and responsibilities of the Procuring Contracting Officer (PCO) as set forth in the Armed Services Procurement Regulations was undertaken. This was followed by a brief review of the two major documents providing guidance and establishing the authorities and responsibilities of a Navy Program Manager, namely the Department of Defense Directive 5000.1 and Secretary of the Navy Instruction 5000.1. GRA

N78-24989# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Statistics.

OPTIMAL CHALLENGES FOR SELECTION

Morris H. DeGroot and Joseph B. Kadane Jan. 1978 30 p refs

(Contract N00014-75-C-0516; Grant NSF SOC-77-07548)

(AD-A052829; TR-143) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper generalizes the problems of optimal selection considered by the authors in an earlier report by allowing a set of J items to be chosen by two decision makers, the first of which has A challenges and the second has B challenges. The two decision-makers have an opportunity to challenge each item before it is accepted, in some fixed order which we leave arbitrary. We assume that the decision-makers know the utility function of the other side as well as their own over sets of J items, and that they know the subjective distribution assigned by the other side of characteristics of potential items that will be observed, as well as their own. Under these conditions the other side's response to each potential time can be predicted with certainty, and backward induction defines an optimal strategy. The authors study an important special case we call regular, and show that it is never disadvantageous to go first in the regular case. The use of peremptory challenges in jury trials motivates our model. GRA

N78-24990# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.

AN EMPIRICAL STUDY OF THE IMPACT OF A PRODUCTION RATE CHANGE ON THE DIRECT LABOR REQUIREMENTS FOR AN AIRFRAME MANUFACTURING PROGRAM M.S. Thesis

Duane E. Congleton Sep. 1977 146 p refs

(AD-A052720; AFIT-LSSR-23-77B) Avail: NTIS HC A07/MF A01 CSCL 05/1

This study examined the impact on direct labor requirements resulting from externally caused production rate changes in the T-38/F-5 airframe production program. The basis for the study was the research conducted at the University of Oregon by Lieutenant Colonel Larry L. Smith in 1975-76. He used a modification to the standard learning curve model and devised a procedure to determine the forecasting ability of the model using data from the F-4, F-102, and KC-135 programs. Smith found that production rate, as expressed in his modified model, showed a significant inverse relationship to direct labor requirements. Additionally, his model provided substantially improved labor requirment forecasts as compared to corresponding forecasts provided by the standard learning curve model. In this study, which replicated Smith's research using T-38/F-5 data, Smith's findings and conclusions were validated. Based on the consistency of findings, Smith's model is recommended for use in forecasting direct labor requirements in active airframe production programs. Author (GRA)

N78-24176*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

DYNAMIC SPARES PROVISIONING FOR THE DSN

I. Eisenberger and G. Lorden *In its* The Deep Space Network 15 Dec. 1977 p 119-124 refs (For availability see N78-24161 15-12)

Avail: NTIS HC A11/MF A01 CSCL 05A

N78-24244*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

AN EFFECTIVE PROCUREMENT AND FINANCIAL MANAGEMENT REPORTING SYSTEM

J. B. Rozek and F. R. Maiocco *In its* The Deep Space Network 15 Apr. 1978 p 289-310 ref (For availability see N78-24212 15-12)

Avail: NTIS HC A14/MF A01 CSCL 05A

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N78-24991# California Univ., Los Angeles.
INFORMATION FLOW INTO RESEARCH AND DEVELOPMENT PROJECTS: AN EXPLORATORY STUDY OF THE FLOW OF IMPORTANT INFORMATION Ph.D. Thesis
Lawrence Raffety Cotter 1977 214 p refs
Avail: NTIS HC A10/MF A01 CSCL 05B

Engineers, managers, and a few scientists who form the management nuclei of three moderate-sized, U.S. matrix research and development projects described 107 communication links that provided important information from personal or impersonal sources outside their projects. The information flow is discussed in terms of its type, strength, and importance, as well as the primary role, the personality type, and perceived relative status of the receiver, and the degree of perceived dysfunctional filtering. Types of information included data supporting the organizational processes of progress-comparison, measurement-validation, and resource maintenance. Personality type was assessed with the Myers-Briggs Type Indicator which uses C.G. Jung's typology. A strong relationship between the subject's primary role and the type of information he receives was not supported. However, importance, status, and dysfunctional filtering were mutually interactive, and dysfunctional filtering had pervasive effects on information flow. Author

N78-24992# Council for Scientific and Industrial Research, Pretoria (South Africa).
WRITING INFORMATIVE REPORTS ON INVESTIGATIONS IN SCIENCE AND ENGINEERING
C. G. Bruckmann and W. G. B. Mandersloot Jul. 1977 51 p refs Prepared in cooperation with Witwatersrand Univ.
(CSIR-CENG-191; ISBN-0-7988-1163-3) Avail: NTIS HC A04/MF A01

The essential points and common problems encountered in preparing a report on a completed item of scientific or engineering research are discussed in this guide which aims to improve communication between author and audience by bringing structure to the message accentuating the important points, removing noise, and applying filters where required. Author

N78-24993# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AERONAUTICAL KNOWLEDGE (SELECTED ARTICLES)
12 Dec. 1977 41 p Transl. into ENGLISH from Hang K'ung Chih Shih, (China), no. 1, Jan. 1977 p 6, 11-13, 25-29, 35-37
(AD-A051708; FTD-ID(RS)T-1460-77) Avail: NTIS HC A03/MF A01 CSCL 01/2

The following topics are outlined: (1) Return of artificial satellite to earth; (2) Science modernization to service people at capital airports; (3) The educational revolution; (4) Use of a carrier to transport satellites and spacecraft; (5) Testing of liquid rocket engines; and (6) Space factories. G.G.

N78-24994# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INFORMATION PROCESSING TECHNIQUES PROGRAM. VOLUME 2: COMMUNICATIONS-ADAPTIVE INTERNETTING Semiannual Technical Summary Report, 1 Apr. - 30 Sep. 1977
30 Sep. 1977 20 p refs
(Contract F19628-76-C-0002; ARPA Order 2929)
(AD-A051320; ESD-TR-77-296) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report describes work performed on the Communications-Adaptive Internetting program sponsored by the Information Processing Techniques Office of the Defense Advanced Research Projects Agency during the period 1 April through 30 September 1977. Author (GRA)

N78-24995# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
PRELIMINARY NTIP SYSTEM CONCEPT AND ALTERNATIVE CONFIGURATIONS. ADDENDUM: CONCEPT OF THE USER-DATA MATCH MODEL
27 Jan. 1978 145 p
(Contract N00600-76-C-1352)
(AD-A051312; FR-77-12-150-ADD) Avail: NTIS HC A07/MF A01 CSCL 05/9

The objectives and approach to the development of the user-data match model are outlined and conclusions and recommendations are provided. The approach to the development of the model considers analysis of personnel characteristics, selection of ratings for the user sample, ranking of ratings by aptitude test scores, and analysis of Navy training and experience requirements. Analysis of task characteristics considers maintenance of task data sources, development of task action data base, definition of levels of hardware complexity, and analysis of presentation techniques. Identification of presentation components relates human factors principles to technical information including readability findings involving TM users. G.G.

N78-24996# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
PRELIMINARY NTIP SYSTEM CONCEPT AND ALTERNATIVE CONFIGURATIONS, TASK 3 Final Report, 24 Jan. 1977 - 27 Jan. 1978
J. E. Connell, J. J. Goldberg, V. L. Kefauver, J. W. Kelsey, and A. Laicato 27 Jan. 1978 246 p refs
(AD-A051311; FR-77-12-150) Avail: NTIS HC A11/MF A01 CSCL 05/9

This Task 3 report documents the preliminary system concept decisions for the NTIP System, together with the alternatives from which the system choices were selected. It represents the output of the third of seven tasks in Phase 1 of the Navy Technical Information Presentation Program (NTIPP) under the above-cited contract number. The technical approach to this task involved the application of systems engineering principles and methodology to operate upon the data base produced in Task 1, and constrained by the preliminary requirements established in Task 2. The preliminary system concept described in this Task 3 report will be further exercised and refined through the performance and cost effectiveness tradeoffs of Tasks 4 and 5. Author (GRA)

N78-24997# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
NTIPP FLEET SURVEY OF TECHNICAL MANUAL USERS Final Report, Nov. 1976 - Jan. 1978
J. E. Connell, D. W. Gater, J. J. Goldberg, C. W. Jackson, and V. L. Kefauver 16 Jan. 1978 129 p refs
(Contract N00600-76-C-1352; ZF55522003)
(AD-A051310; FR-77-12-1138) Avail: NTIS HC A07/MF A01 CSCL 05/9

This special report documents the NTIPP Fleet Survey of MOTD Users, conducted between 22 October 1976 and 31 December 1976, under the provisions of the above-cited contract number. The approach to the survey included a structured questionnaire and direct interview of technician-level MOTD users. The survey involved a total of 427 respondents. A reasonable stratification of respondents was employed, within the constraints of schedule, costs, and availability of ships and technicians. The survey was limited to shipboard and shore-based elements of the Pacific Fleet. It should be noted that the problems reported herein are based on stated user preferences and as such should be subjected to further analysis and cost effectiveness studies prior to implementation actions. However, the survey provides valuable input from the user community to the overall NTIPP effort. Author (GRA)

N78-24998# Index Systems, Inc., Cambridge, Mass.
GUIDELINES FOR PREPARING AND REVIEWING FEASIBILITY STUDIES
Apr. 1977 149 p refs
(Contract EPA-68-01-3836)
(PB-274757) Avail: NTIS HC A07/MF A01 CSCL 05B

Considerations essential to making a sound decision on whether or not to use automatic data processing equipment for

a specific project are discussed. The basic issues involved include: (1) the establishment of a clear, comprehensive and current definition of and justification for system requirements; (2) an analysis of several feasible alternative approaches such as manual, semi-automated, or fully-automated systems; and (3) a cost/benefit and cash/flow analysis of alternative methods. Procedures to be followed in performing the study are examined as well as the nine major tasks to be performed, and guidelines are given for reviewing and evaluating the feasibility study. A.R.H.

N78-24248# Joint Publications Research Service, Arlington, Va.
INEFFICIENT DISTRIBUTION OF SCIENTIFIC INFORMATION CRITICIZED
Engr. G. Beltova *In its* Transl. on Eastern Europe: Sci. Affairs, No. 583 (JPRS-71140) 18 May 1978 p 18-22 Transl. into ENGLISH from Tekhnichesko Delo (Sofia), 25 Feb. 1978 p 1-5
(For availability see N78-24245 15-12)
Avail: NTIS HC A03/MF A01

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N78-24999# Defense Systems Management School, Fort Belvoir, Va.
LIFE COST MANAGEMENT, METHODOLOGY, AND CASE STUDIES
Andrew H. Berard Oct. 1977 64 p refs
(AD-A052388) Avail: NTIS HC A04/MF A01 CSCL 14/1

This study project examines the management policies that have initiated O and S cost control and the progress made on O and S costing methodology. Costing guidelines prepared by LMI are summarized to provide the reader with an overview of the guidelines content and a preview of CAIG O and S costing methodology guidelines. The RAND report on LCC analysis for aircraft turbine engines provides analysis methods that allows performance to be assessed with the present technology and determines cost and schedule risks. Further, commercial operational and maintenance practices are reviewed for military applicability. Three case studies representative of LCC management techniques are discussed in detail showing the impact of logistics alternatives, reliability by design, and maintainability features that contribute towards reduced O and S costs and lower LCC. The cases were selected from a LCC Seminar held on 29 Sept. 1977. The Army's Black Hawk program, Navy's F-18 program, and the Air Force's ARC-164 program are the three case studies selected. Important lessons learned on all three of the case studies should serve as models for other programs to follow that are concerned with LCC procurement. The results of the case studies provide positive indications that LCC management does work and can provide affordable systems. Author (GRA)

N78-24199*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE ROLE OF INTEREST AND INFLATION RATES IN LIFE-CYCLE COST ANALYSIS
I. Eisenberger, D. S. Remer, and G. Lorden (Calif. Inst. of Technol.) *In its* The Deep Space Network 15 Feb. 1978 p 105-109 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 05C

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N78-25000# Committee on Interstate and Foreign Commerce (U. S. House).
NATIONAL ENERGY ACT, PART 4
Washington GPO 1977 918 p refs Hearings on H.R. 6831, H.R. 687, H.R. 1562, H.R. 2088, H.R. 2818, H.R. 3317, H.R. 3664, H.R. 6660, and all similar and identical bills before Subcomm. on Energy and Power of the Comm. on Interstate and Foreign Commerce, 95th Congr., 1st Sess., 25-27 May 1977
(GPO-96-231) Avail: Subcomm. on Energy and Power

The topic of discussion for this hearing was the use of coal conversion to supplement the nation's energy needs. Included in the testimonies is the emphasis placed on coal conversion as it relates to economics, public health and environmental impact. G.Y.

N78-25001# Committee on Interstate and Foreign Commerce (U. S. House).
NATIONAL ENERGY ACT, PART 5
Washington GPO 1977 505 p refs Hearings on H.R. 6831, H.R. 687, H.R. 1562, H.R. 2088, H.R. 2818, H.R. 3317, H.R. 3664, H.R. 6660, and all similar and identical bills before the Subcomm. on Energy and Power of the Comm. on Interstate and Foreign Commerce, 95th Congr., 1st Sess., 1 Jun. 1977
(GPO-98-577) Avail: Subcomm. on Energy and Power

Evaluation of the President's proposed National Energy Act on a broad and long term view are reported. Through economic analysis the overall goals and impacts of the President's plan are evaluated and recommendations are set forth. A collection of data are presented to give a better understanding to the proposed plan and recommendations. G.Y.

N78-25002# Committee on Finance (U. S. Senate).
THE FUEL EFFICIENCY INCENTIVE TAX PROPOSAL: ITS IMPACT UPON THE FUTURE OF THE US PASSENGER AUTOMOBILE INDUSTRY
Washington GPO 1977 302 p refs Rept. on Investigation No. 332-86 under Section 332 of the Tariff Act of 1930 to the Comm. on Finance, 95th Congr., 1st Sess., Jul. 1977
(GPO-93-188) Avail: SOD HC

The impact of the fuel inefficiency tax and the fuel efficiency rebate (sections 1201-1204 of the proposed National Energy Act) on consumption and sales of U.S. and foreign automobiles, on employment in the U.S. automobile industry, and on U.S. consumers of passenger automobiles is assessed. This analysis, which is for the period 1978 through 1985, is based on three different assumptions: (1) the U.S. market under existing laws and regulations; (2) the U.S. market with the implementation of both the tax and the rebate; and (3) the U.S. market with the implementation of the fuel efficiency tax only. Author

N78-25003*# ECON, Inc., Princeton, N. J.
POLITICAL AND LEGAL IMPLICATIONS OF DEVELOPING AND OPERATING A SATELLITE POWER SYSTEM Final Report
George A. Hazelrigg, Jr. 15 Aug. 1977 234 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-954652)
(NASA-CR-157077; ECON-77-195-1) Avail: NTIS HC A11/MF A01 CSCL 05D

A number of political and legal implications of developing and operating a satellite power system (SPS) are identified and studied in this report. These include the vulnerability of SPS to actions of adversaries, communications impacts, the legality of an SPS in orbit including on-orbit military protection, alleviation of political concerns about deployment and operation of SPS, programmatic planning for SPS and the interaction of SPS with federal regulatory agencies and major departments. In comparing SPS to terrestrial power stations, it is seen that the political problems are neither clearly larger nor clearly smaller--they are clearly different and they are internationational in nature. If SPS is to become a reality these problems must be dealt with. Five major issues are identified. These must be resolved in order to obtain international acceptance of SPS. However, this study has found no insurmountable obstacles that would clearly prohibit the deployment, operation and protection of an SPS fleet. Author

N78-25004# Committee of the Whole House on the State of the Union (U. S. House).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT-INDEPENDENT AGENCIES APPROPRIATION BILL, 1979
Washington GPO 1978 77 p refs Rept. together with

additional views to accompany H.R. 12936 for Comm. on Appropriations, 85th Congr., 2d Sess., 1 Jun. 1978
(H-Rept-95-1255) Avail: US Capitol, House Document Room

The Committee recommends $68,208,848,000 in new budget (obligational) authority for the Department of Housing and Urban Development and seventeen independent agencies and offices. This is $1,308,686,000 below the budget estimates considered and $6,099,753,000 below the comparable amounts appropriated for fiscal year 1978. The budget estimate of $1,040,000,000 for the antirecession financial assistance fund of the Department of the Treasury is being deferred pending final congressional action on the authorizing legislation. Further details concerning this action can be found in the report. Author

N78-25005# Committee on Science and Technology (U. S. House).
THE 1979 NASA AUTHORIZATION, VOLUME 1, PART 2
Washington GPO 1978 925 p refs Hearings on H.R. 10664 (superseded by H.R. 11401) before Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 95th Congr., 2d Sess., 1, 2, and 7 Feb. 1978
(GPO-25-181) Avail: Subcomm. on Space Sci. and Applications

Testimony given and statements received for the record are presented in support of NASA funding requests for the space transportation system, space exploration and utilization projects, solar propulsion and energy conversion technology, and the search for extraterrestrial intelligence. Special emphasis is given to the space shuttle and Spacelab payloads, the Seasat-A and infrared astronomical satellites, the Galileo and Voyager missions and the joint NASA-ESA solar polar missions. A.R.H.

N78-25006# Committee on Science and Technology (U. S. House).
THE 1978 ERDA AUTHORIZATION; THE CLINCH RIVER BREEDER REACTOR PROGRAM, VOLUME 4
Washington GPO 1977 1129 p refs Hearings before Subcomm. on Fossil and Nuclear Energy Res., Development and Demonstration of the Comm. on Sci. and Technol., 95th Congr., 1st Sess., 7-10 Jun. 1977
(GPO-92-462) Avail: Subcomm. on Fossil and Nuclear Energy Res., Development and Demonstration

Testimony was given on different technical alternatives for the breeder reactor research and development program. Particular emphasis was given to the Clinch River breeder reactor project. The minimum criterion of acceptability for the commercialization of an energy supply alternative was discussed. The plutonium breeder and its associated fuel cycle was not felt by many to meet the minimum criterion of acceptability and alternative energy sources were discussed such as the denatured uranium-thorium fuel cycle. Author

N78-25007# Committee on Foreign Relations (U. S. Senate).
INTERNATIONAL COMMUNICATIONS AND INFORMATION
Washington GPO 1977 288 p refs Hearings before Subcomm. on International Operations of the Comm. on Foreign Relations, 95th Congr., 1st Sess., 8-10 Jun. 1977
(GPO-93-147) Avail: SOD HC

Testimony was presented by various members of the news media regarding international policies which affect the acquisition and dissemination of information. The hearings were held in an attempt to determine the current situation in regard to international communications issues, what trends are developing, and what problems may arise in the future. P.R.A.

N78-25008# Army War Coll., Carlisle Barracks, Pa. Strategic Studies Inst.
BALANCE OF POWER IN OUTER SPACE
William W. Brown 30 Jan. 1978 23 p refs
(AD-A051693) Avail: NTIS HC A02/MF A01 CSCL 15/7

This memorandum discusses the importance of controlling space, or at least precluding control by a hostile power, which the author perceives may be just as critical in future warfare as control of the seas or airspace. He asserts that, in the final analysis, the decisiveness of space power must be expressed in relative terms. The author concludes that if both the United States and the Soviet Union have significant support from space at more or less equal levels, then the decisive factors will remain elsewhere--so long as the capability to negate this support remains in balance. If, however, either side achieves exclusive use of space or even a preponderant amount of space support, the probability of a decisive effect from space appears to be very high. Author (GRA)

N78-25009# National Technical Information Service, Springfield, Va.
PROFESSIONAL STANDARDS REVIEW ORGANIZATIONS (PSRO'S). A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978
Pernell W. Crockett Mar. 1978 86 p
(NTIS/PS-78/0229) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 05D

The development, implementation, and evaluation of professional standards review organizations (PSRO's) as legislated under provisions of P.L. 92-603 were cited. Studies included the legislative history and legal implications of PSRO's, and their role in quality, utilization, and costs of medical care. References on the establishment of PSRO's for various medical occupations are included. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N78-25010*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESPONSE OF LEAD-ACID BATTERIES TO CHOPPER-CONTROLLED DISCHARGE
Robert L. Cataldo [1978] 11 p refs Proposed for presentation at the 13th Intersoc. Energy Conversion Eng. Conf., San Diego, Calif., 20-25 Aug. 1978 Revised
(Contract EC-77-A-31-1044)
(NASA-TM-73834-Rev; E-9421; CONS/1044-1) Avail: NTIS HC A02/MF A01 CSCL 13F

The preliminary results of simulated electric vehicle, chopper, speed controller discharge of a battery show energy output losses at up to 25 percent compared to constant current discharges at the same average discharge current of 100 A. These energy losses are manifested as temperature rises during discharge, amounting to a two-fold increase for a 400-A pulse compared to the constant current case. Because of the potentially large energy inefficiency, the results suggest that electric vehicle battery/speed controller interaction must be carefully considered in vehicle design. Author

N78-25011*# Ford Motor Co., Dearborn, Mich.
CERAMIC REGENERATOR SYSTEMS DEVELOPMENT PROGRAM Progress Report, 1 Oct. 1977 - 31 Dec. 1977
J. A. Cook, C. A. Fucinari, J. N. Lingscheit, C. J. Rahnke, and V. D. Rao Feb. 1978 90 p refs Sponsored in part by NASA
(Contracts EC-77-A-31-1040; Den-3-8)
(NASA-CR-135380; CONS/0008-2) Avail: NTIS HC A05/MF A01 CSCL 13F

The results of 4,665 hours of turbine engine durability testing accumulated are described. Two materials, aluminum silicate and magnesium aluminum silicate, continue to show promise toward achieving the durability objectives of this program. A regenerator core made from aluminum silicate shows minimal evidence of chemical attack damage after 7283 hours of engine tests at 800 C (1472 F) and another shows little distress after 4314 hours at 982 C (1800 F). The results obtained during this period in ceramic material screening tests, aero-thermodynamic performance tests, stress anlaysis, cost studies, and material specifications are also included in this report. Author

N78-25012*# National Aeronautics and Space Administration, Washington, D. C.

WASTE HEAT UTILIZATION IN INDUSTRIAL PROCESSES
M. Weichsel and W. Heitmann Apr. 1978 35 p refs Transl. into ENGLISH from Tech. Mitt. (West Ger.), v. 70, no. 5, May 1977 p 259-272 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75210) Avail: NTIS HC A03/MF A01 CSCL 10B

A survey is given of new developments in heat exchangers and heat pumps. With respect to practical applications, internal criteria for plant operation are discussed. Possibilities of government support are pointed out. Waste heat steam generators and waste heat aggregates for hot water generation or in some cases for steam superheating are used. The possibilities of utilization can be classified according to the economic improvements and according to their process applications, for example, gascooling. Examples are presented for a large variety of applications. Author

N78-25013# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Civil Engineering.
EVALUATION OF LEACHATE TREATMENT. VOLUME 2: BIOLOGICAL AND PHYSICAL-CHEMICAL PROCESSES Final Report
Edward S. K. Chian and Fopae B. DeWalle Nov. 1977 266 p refs
(Contract EPA-68-03-0162)
(PB-277038/6; EPA-600/2-77-186b-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 13B

A completely mixed anaerobic filter was found to effectively remove organic matter concentrations in high-strength solid waste leachate over a range of organic loadings and shockloads. Phosphate requirements of the aerobic biomass were extensively evaluated. Kinetic constants were calculated for optimum conditions. The settling and dewatering characteristics of the sludge from the aerated lagoons were studied. The combined treatment of leachate and municipal sewage in a conventional plugflow activated sludge unit was found to effectively treat high strength leachate. GRA

N78-25014# National Technical Information Service, Springfield, Va.
URBAN FINANCING AND TAXATION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar. 1978
Edward J. Lehmann Mar. 1978 234 p Supersedes NTIS/PS-77/0204; NTIS/PS-76/0229; NTIS/PS-75/199
(NTIS/PS-78/0250; NTIS/PS-77/0204; NTIS/PS-76/0229; NTIS/PS-75/199) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Methods of financing and taxation for urban areas are discussed. The studies cover the planning, implementation, amount of revenues raised, and the effects of financing and taxation. A relatively large number of reports on property taxes are included. Author

N78-25015 National Technical Information Service, Springfield, Va.
FINANCING AND TAXATION FOR URBAN CONTROL OF POLLUTION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar. 1978
Edward J. Lehmann Mar. 1978 202 p Supersedes NTIS/PS-77/0240; NTIS/PS-76/0228; NTIS/PS-75/202
(NTIS/PS-78/0273; NTIS/PS-77/0240; NTIS/PS-76/0228; NTIS/PS-75/202) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The citations relate to urban and regional planners who wish to study means of financing pollution abatement programs and of taxing sources as a means of pollution reduction. The reports are divided into three sections: air pollution studies, solid waste disposal studies, and water pollution and sewage treatment studies. Author

N78-25016# Pennsylvania Univ., Philadelphia. Dept. of Economics.
WORLD DEMAND FOR RAW MATERIALS IN 1985 AND 2000
W. Malenbaum Oct. 1977 161 p
(Grant NSF AER-75-23687)
(PB-277707; NSF/RA-770421) Avail: NTIS HC A08/MF A01 CSCL 05A

The future demand for the following minerals and metals in 1985 and in 2000 that are important inputs for industrial output throughout the world is analyzed: aluminum, chrome, cobalt, copper, iron, maganese, nickel, platinum, steel, tin, tungsten, and zinc. Together, they account for 80-90 percent of the value of world mineral production. Objectives are: (1) to provide realistic estimates of demand for these twelve materials in the future periods for the world, and for the ten component regions into which the world is divided; and (2) to contribute to methodology for such projections through application of intensity-of-use procedures. Strong support is provided of the relevance of the intensity-of-use method for deriving estimates of future demand for materials, including estimates for regions of the world with limited economic data. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N78-25017*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ENGINEERING TESTS OF THE C-141 TELESCOPE
Edwin F. Erickson and Donald W. Strecker May 1978 9 p
(NASA-TM-78467; A-7323) Avail: NTIS HC A02/MF A01 CSCL 20F

Data on image quality, chopper performance, and the closed-loop operation of the 91 cm telescope of the Kuiper Airborne Observatory which were obtained in September 1977 are presented. Author

N78-25018# Dudley Observatory, Albany, N.Y.
DUDLEY OBSERVATORY RADIO TELESCOPE PROJECT Final Report, 1 Jul. 1971 - 30 Jun. 1976
Joseph W. Erkes 17 Feb. 1978 53 p refs
(Contract N00014-72-C-0040)
(AD-A051844) Avail: NTIS HC A04/MF A01 CSCL 03/2

This document contains summaries of the work done over the contract period in four major areas: telescope design and construction, electronics design and construction, signal processing theory and science. In addition, this document contains appendices in which reprints of several published articles and abstracts appear. GRA

N78-25019# Federal Electric Corp., Vandenberg AFB, Calif.
STAR LOOK ANGLE COMPUTATION Final Report, 1 Jul. 1976 - 15 Aug. 1977
George Sinclair 15 Aug. 1977 192 p refs
(Contract F04703-77-C-0111)
(AD-A051658; PA100-77-37; SAMTEC-TR-77-221) Avail: NTIS HC A09/MF A01 CSCL 03/1

The STAR 1 program was prepared to replace a current SAMTEC Star Look Angle program run on the IBM 7094 computer by a program of higher accuracy which runs on the IBM 360/65 computer. The program is organized in module form for easy use in other programs. The design accuracy (neglecting refraction corrections) is 0.01 arcseconds for both azimuth and elevation angles. This program, with the proper BLOCK DATA, will produce look angles at a given site for a given time block (in hours) for as many days as desired, up to January 1 of the next year. The coding was prepared in FORTRAN IV. Running speed is about 1.4 CPU seconds per star-station-day with polar motion corrections and a 1/2 hour integration step size. Author (GRA)

N78-25020# National Technical Information Service, Springfield, Va.
SOLAR ECLIPSES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978
George W. Reimherr Mar. 1978 168 p Supersedes NTIS/PS-75/229
(NTIS/PS-78/0241; NTIS/PS-77/0250; NTIS/PS-76/0131; NTIS/PS-75/229) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 03A

The bibliography cites observations of solar radiation, solar corona, and effects on the earth's atmosphere, taken during solar eclipses. Observations from the eclipses of 1961 through 1978 are included. (This updated bibliography contains 163 abstracts, 3 of which are new entries to the previous edition.) Author

N78-25043# Joint Publications Research Service, Arlington, Va.
THE FIRST TWENTY YEARS OF THE SPACE ERA AND ASTRONOMY
I. S. Shklovskiy *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 30 (JPRS-707-14) 2 Mar. 1978 p 68-77 Transl. into ENGLISH from Priroda (Moscow), no. 10, 1977 p 86-92 (For availability see N78-25037 15-99)
Copyright. Avail: NTIS HC A06/MF A01

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N78-25021*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GRAIN FORMATION IN ASTRONOMICAL SYSTEMS: A CRITICAL REVIEW OF CONDENSATION PROCESSES
Bertram Donn Apr. 1978 24 p refs Proposed for presentation at Conf. on Protostars and Planets, Tucson, Ariz., Nov. 1978 Submitted for publication
(NASA-TM-79542) Avail: NTIS HC A02/MF A01 CSCL 03B

An analysis is presented of the assumption and the applicability of the three theoretical methods for calculating condensations in cosmic clouds where no pre-existing nuclei exist. The three procedures are: thermodynamic equilibrium calculations, nucleation theory, and a kinetic treatment which would take into account the characteristics of each individual collision. Thermodynamics provide detailed results on the composition temperature and composition of the condensate provided the system attains equilibrium. Because of the cosmic abundance mixture of elements, large supersaturations in some cases and low pressures, equilibrium is not expected in astronomical clouds. Nucleation theory, a combination of thermodynamics and kinetics, has the limitations of each scheme. Kinetics, not requiring equilibrium, avoids nearly all the thermodynamics difficulties but requires detailed knowledge of many reactions which thermodynamics avoids. It appears to be the only valid way to treat grain formation in space. A review of experimental studies is given. Author

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N78-25022*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 14 ROCK SAMPLES
Irene C. Carlson May 1978 422 p refs
(NASA-TM-79452; JSC-14240) Avail: NTIS HC A18/MF A01 CSCL 03B

Petrographic descriptions of all Apollo 14 samples larger than 1 cm in any dimension are presented. The sample description format consists of: (1) an introductory section which includes information on lunar sample location, orientation, and return containers, (2) a section on physical characteristics, which contains the sample mass, dimensions, and a brief description; (3) surface features, including zap pits, cavities, and fractures as seen in binocular view; (4) petrographic description, consisting of a binocular description and, if possible, a thin section description; and (5) a discussion of literature relevant to sample petrology is included for samples which have previously been examined by the scientific community. Author

N78-25023*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LITHOLOGICAL MAPS OF SELECTED APOLLO 14 BRECCIA SAMPLES
D. Twedell, S. Feicht, I. C. Carlson, and C. Meyer, Jr. Jan. 1978 94 p refs
(NASA-TM-79453; JSC-13842) Avail: NTIS HC A05/MF A01 CSCL 03B

A booklet of mapped surfaces of some Apollo 14 samples was prepared as an intermediate step towards the preparation of a new Apollo 14 sample catalog. It contains recently obtained observations and pictures of some of the largest and less well documented Apollo breccia samples. Some of the samples (14303, 14305, 14306, and 14311) were chosen because they have large sawn surfaces. These were dusted and mapped using a binocular microscope through the window of the nitrogen cabinet. Author

N78-25024*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CATALOG AND PRELIMINARY DESCRIPTION OF LUNA 24 SAMPLES PRESENTED TO THE USA
J. Stewart Nagle and Wayne J. A. Walton 1 May 1977 87 p
(NASA-TM-79485) Avail: NTIS HC A05/MF A01 CSCL 03B

Information collected during the preliminary processing and allocation of U.S.A. exchange samples from the U.S.S.R. LUNA 24 mission is given. Investigators are provided with information upon which they may select samples for further study. Handling data and early processing history are summarized. Information includes a summary of splits and allocations for all size fractions. Bulk properties of soils are compared. Finally, size histograms of individual lithologic composition classes are presented and composition classes with similar size distributions are identified. Author

N78-24177*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PLANETARY ATMOSPHERE MODELING AND PREDICTIONS
A. L. Berman *In its* The Deep Space Network 15 Dec. 1977 p 125-129 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 03B

N78-24203*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A FAST DFT ALGORITHM USING COMPLEX INTEGER TRANSFORMS
I. S. Reed (Univ. of Southern Calif., Los Angeles) and T. K. Truong *In its* The Deep Space Network 15 Feb. 1978 p 134-140 refs Sponsored in part by AFOSR (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 09B

N78-25045# Joint Publications Research Service, Arlington, Va.
METALLOGRAPHY OF LUNAR IRON
Rafail Isaakovich Mints and Tatyana Mikhaylovich Petukhova *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 30 (JPRS-70714) 2 Mar. 1978 p 94-109 Transl. into ENGLISH from Priroda (Moscow), no. 10, 1977 p 66-76 (For availability see N78-25037 15-99)
Copyright. Avail: NTIS HC A06/MF A01

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N78-25025*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF MODELS TO PREDICT INSOLATION ON TILTED SURFACES
Thomas M. Klucher Mar. 1978 30 p refs
(Contract E(49-26)-1022)
(NASA-TM-78842; E-9556) Avail: NTIS HC A03/MF A01 CSCL 10A

An empirical study was performed to evaluate the validity of various insolation models which employ either an isotropic or an anisotropic distribution approximation for sky light when predicting insolation on tilted surfaces. Data sets of measured hourly insolation values were obtained over a six-month period using pyranometers which received diffuse and total solar radiation on a horizontal plane and total radiation on surfaces tilted toward the equator at 37 deg and 60 deg angles above the horizon. Data on the horizontal surfaces were used in the insolation models to predict insolation on the tilted surface; comparisons of measured versus calculated insolation on the tilted surface were examined to test the validity of the sky light approximations. It was found that the Liu-Jordan isotropic distribution model provides a good fit to empirical data under overcast skies but underestimates the amount of solar radiation incident on tilted surface under clear and partly cloudy conditions. The anisotropic-clear-sky distribution model by Temps and Coulson provides a good prediction for clear skies but overestimates the solar radiation when used for cloudy days. An anisotropic-all-sky model was formulated in this effort which provided excellent agreement between measured and predicted insolation throughout the six-month period. Author

N78-25026*# Stanford Univ., Calif. Inst. for Plasma Research.
RESISTIVE DECAY OF PHOTOSPHERIC CURRENT SHEETS
D. D. Barbosa May 1978 11 p refs
(Grant NGL-05-020-272; Contract N00014-75-C-0673)
(NASA-CR-157152; SU-IPR-744) Avail: NTIS HC A02/MF A01 CSCL 03B

The magnetostatics of thin, axi-symmetric current sheets in the plane of the photosphere are considered. The resistive decay time constant for energy and flux of the system is computed and found to depend linearly on the thickness of the current sheet. Author

N78-25027# Boston Univ., Mass. Dept. of Astronomy.
RADIO FLARE STUDIES AT 4 cm Final Scientific Report, 1 Jul. 1975 - 30 Sep. 1977
Michael D. Papagiannis and Fred L. Wefer Jan. 1978 108 p refs
(Contract F19628-76-C-0027)
(AD-A052360; Ser-2-No-66; AFGL-TR-78-0014) Avail: NTIS HC A06/MF A01 CSCL 03/2

This report describes the efforts made under the present contract to observe and analyze the morphology of solar active regions and flare events. The overall four-year effort (1973-1977) was undertaken in the hope of developing a forecasting scheme which would allow the prediction of major flare events based on the behavior of the brightness temperature $Ta = 1/2\ (Tr-Tl)$ and the circular polarization $P = (Tr-Tl)/(Tr-Tl)$ in the hours, or possibly the days, prior to the erruption of such a flare. During the years 1973-1977, we conducted 63 days of observations with the 120 ft. Haystack antenna at a 4 cm wavelength, logging a total of more than 330 hours of solar observations. Primarily because this was a period of solar minimum, the number of cases observed, and especially those pertaining to major flare events, was relatively small. This fact, compounded by the observed diversity in the behavior of active regions before and during flare events, made it impossible to extract from the data any dependable forecasting scheme. It was concluded, therefore, that this goal can be achieved only with a long term project using a dedicated facility which over the period of a solar cycle could obtain a large enough number of events to make any statistical interpretation of the results meaningful. Though the main goal of the project was not realized, our efforts allowed us to gain a better perspective of the magnitude of the task and an understanding of the ways through which the forecasting effort should be approached. Our work produced also several other results, in which we were more successful. GRA

N78-24167*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A FIRST-PRINCIPLES DERIVATION OF DOPPLER NOISE EXPECTED FROM SOLAR WIND DENSITY FLUCTUATIONS
P. S. Callahan *In its* The Deep Space Network 15 Dec. 1977 p 42-53 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 03B

N78-24178*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EMPIRICAL MODEL FOR THE SOLAR WIND VELOCITY
A. L. Berman *In its* The Deep Space Network 15 Dec. 1977 p 130-134 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 03B

N78-24179*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RMS ELECTRON DENSITY FLUCTUATION AT 1 AU
A. L. Berman *In its* The Deep Space Network 15 Dec. 1977 p 135-140 refs (For availability see N78-24161 15-12)
Avail: NTIS HC A11/MF A01 CSCL 03B

N78-24201*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GROUND TRACKING SYSTEM PHASE FLUCTUATION SPECTRA
A. L. Berman *In its* The Deep Space Network 15 Feb. 1978 p 125-128 refs (For availability see N78-24187 15-12)
Avail: NTIS HC A12/MF A01 CSCL 03B

N78-24221*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN ANALYSIS OF VIKING S-X DOPPLER MEASUREMENTS OF SOLAR WIND COLUMNAR CONTENT FLUCTUATIONS
P. S. Callahan *In its* The Deep Space Network 15 Apr. 1978 p 75-81 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 03B

N78-24231*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTRON DENSITY AND DOPPLER RMS PHASE FLUCTUATION IN THE INNER CORONA
A. L. Berman *In its* The Deep Space Network 15 Apr. 1978 p 172-179 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 03B

N78-24232*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DDS RADIO SCIENCE SUBSYSTEM: REAL-TIME BANDWIDTH REDUCTION AND WIDEBAND RECORDING OF RADIO SCIENCE DATA
A. L. Berman *In its* The Deep Space Network 15 Apr. 1978 p 180-188 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 03B

N78-24234*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR WIND TURBULENCE MODELS EVALUATED VIA OBSERVATIONS OF DOPPLER RMS PHASE FLUCTUATION AND SPECTRAL BROADENING IN THE INNER CORONA
A. L. Berman *In its* The Deep Space Network 15 Apr. 1978 p 197-202 refs (For availability see N78-24212 15-12)
Avail: NTIS HC A14/MF A01 CSCL 03B

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N78-25028*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CONSEQUENCES OF NARROW CYCLOTRON EMISSION FROM HERCULES X-1
Robert P. Weaver Apr. 1978 12 p refs Submitted for publication
(NASA-TM-78115) Avail: NTIS HC A02/MF A01 CSCL 03B

The implications of the recent observations of a narrow cyclotron line in the hard X-ray spectrum of Hercules X-1 are studied. A Monte Carlo code is used to simulate the X-ray transfer of an intrinsically narrow feature at approximately 56 keV through an opaque, cold magnetospheric shell. The results of this study indicate that if a narrow line can be emitted by the source region, then only about 10% of the photons remain in a narrow feature after scattering through the shell. The remaining photons are scattered into a broad feature (FWHM approximately 30 keV) that peaks near 20 keV. Thus, these calculations indicate that the intrinsic source luminosity of the cyclotron line is at least an order of magnitude greater than the observed luminosity.
Author

N78-24246# Joint Publications Research Service, Arlington, Va.
BIOLOGICAL SATELLITES, STUDY OF COSMIC RADIATION DISCUSSED
Eva Misurova and Ivan Ahlers *In its* Transl. on Eastern Europe: Sci. Affairs, No. 583 (JPRS-71140) 18 May 1978 p 1-4 Transl. into ENGLISH from Tvorba (Prague), no. 12, 22 Mar. 1978 p 10 (For availability see N78-24245 15-12)
Avail: NTIS HC A03/MF A01

99 GENERAL

N78-25029+ Engineering Sciences Data Unit, London (England).
ENGINEERING SCIENCES DATA UNIT, INDEX 1977-78
1977 408 p
Copyright. Avail: NTIS ATTN: ESDU, Springfield, Va. 22161. (Write for prices)
Nearly 700 authoritative data items issued in the form of data sheets and memoranda by the Engineering Sciences Data Unit, and available as of January 1, 1978 are indexed to provide a ready reference for application to a wide range of engineering design projects. Crossreferencing of entries is generous. Directions for using the keyword index are included. A.R.H.

N78-25030# Indian Inst. of Science, Bangalore.
PROGRAMS, RESEARCH, AND ADMINISTRATION OF INDIAN INSTITUTE OF SCIENCE Annual Report, 1976 - 1977
1977 125 p refs
(AR-68) Avail: NTIS HC A06/MF A01
The Sixtyeighth Annual Report on the work and activities of the Indian Institute of Science for the year 1976-77 is presented. On the recommendations of a Visiting Committee, the University Grants Commision approved an amount of Rs. 452 lakhs for the total outlay during the Fifth Plan proposed by the Institute. An action plan for implementation and execution of work is in progress. Developments planned during the Fifth Plan include: (1) establishment of a Materials Research Center; (2) expansion in computer facilities; (3) additional support for instrument service and fabrication facilities; (4) a new laboratoy building for the Molecular Biophysics Unit, and (5) renovation of several old laboratories - Inorganic and Physical Chemistry, Biochemistry, Physics. To meet the needs of increasing tempo of the Continuing Education Programme the construction of a new hostel block was planned. Author

N78-25031# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 36
18 May 1978 52 p refs Transl. into ENGLISH from selected Russian articles 50 p
(JPRS-71139) Copyright. Avail: Issuing Activity
Articles on communications, acoustics, and space exploration are presented. Topics covered include semiconductor devices, lasers, pulse compression, and accomplishments of Salyut-6. For individual titles, see N78-25032 through N78-25036.

N78-25032# Joint Publications Research Service, Arlington, Va.
POWER AND RADIATING FREQUENCY OF SEMICONDUCTOR TRANSMITTING ANTENNA ARRAYS c32
G. P. Zemtsov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 36 (JPRS-71139) 18 May 1978 p 12-20 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (Kiev) v. 21, no. 2, 1978 p 96-101 (For availability see N78-25031 15-99)
Copyright. Avail: Issuing Activity
The power capabilities of an active antenna array made of semiconductor active elements are estimated along with the thermal limitation of the maximum radiated power. Author

N78-25033# Joint Publications Research Service, Arlington, Va.
FEASIBILITY OF PARAMETRIC STIMULATED EMISSION AND AMPLIFICATION OF ELECTROMAGNETIC WAVES WITH FREQUENCIES HIGHER THAN THAT OF THE PUMPING WAVE, IN ELECTRON FLUXES c32
A. M. Kalmykov, N. Ya. Kotsarenko, and V. V. Kulish *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 36 (JPRS-71139) 18 May 1978 p 21-24 ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (Kiev), v. 20, no. 10, 1977 p 76-78 (For availability see N78-25031 15-99)
Copyright. Avail: Issuing Activity
A principle of active parametric upward conversion of frequency in electron fluxes is considered. It is demonstrated that in electron fluxes the low frequency electromagnetic pumping wave that propagates counter to the electron flux may stimulate or amplify a high frequency electromagnetic wave and a slow space charge wave. Application of this principle to the development of high power parametric oscillators and wave amplifiers in the millimeter and submillimeter bands is proposed. J.M.S.

N78-25034# Joint Publications Research Service, Arlington, Va.
ANALYSIS OF A COMPRESSION SYSTEM WITH DISCRETE FREQUENCY MODULATION IN SURFACE ACOUSTICAL WAVES c71
V. T. Pershin, V. G. Basov, and V. N. Sinitsa *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 36 (JPRS-71139) 18 May 1978 p 25-29 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (Kiev), v. 21, no. 3, 1977 p 95-97 (For availability see N78-25031 15-99)
Copyright. Avail: Issuing Activity
The shape and parameters of a compressed pulse in a compression system based on surface acoustic waves with discrete frequency modulation are calculated and the possibility of suppression of sidelobes by apodization of the transducer is analyzed. Author

N78-25035# Joint Publications Research Service, Arlington, Va.
TASS REPORTS ON PRESS CONFERENCE WITH SALYUT-6 PARTICIPANTS c12
In its Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 36 (JPRS-71139) 18 May 1978 p 12-20 Transl. into ENGLISH from Pravda (Moscow), 12 Apr. 1978 p 3 (For availability see N78-25031 15-99)
Avail: Issuing Activity
A press conference devoted to the acomplishments of the Salyut-6 orbital station is briefly reviewed. The significance of the 96-day flight of the orbiting space complex and the scientific and technical experiments performed during the flight are discussed. J.M.S.

N78-25036# Joint Publications Research Service, Arlington, Va.
SOVIET LASER IMPROVEMENTS DISCUSSED c36
O. Gusev *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 36 (JPRS-71139) 18 May 1978 p 41-42 Transl. into ENGLISH from Pravda (Moscow), 20 Apr. 1978 p 6 (For availability see N78-25031 15-99)
Avail: Issuing Activity
Development of a laser which can change the color of its beam is described. Application areas of frequency-tunable lasers are included. J.M.S.

N78-25037# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 30
2 Mar. 1978 124 p refs Transl. into ENGLISH from various Russian journals
(JPRS-70714) Copyright. Avail: NTIS HC A06/MF A01

Reports are given on technological advances in data processing equipment, lasers, inertial guidance systems, clocks, and automatic control devices. The impact of space exploration on the science of astronomy is discussed. Results are also presented on studies of the earth's crust by spaceborne photography and on the analysis of lunar samples. For individual titles, see N78-25038 through N78-25045.

N78-25038# Joint Publications Research Service, Arlington, Va.
PRINCIPLES OF CONSTRUCTING INTERFACING DEVICES OF THE SM-3 CONTROL COMPUTER **c62**
A. Ya. Sokolov and E. V. Keshek *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 30 (JPRS-70714) 2 Mar. 1978 p 9-17 Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 11, 1977 p 9-11 (For availability see N78-25037 15-99)
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The design base of SM-3 computer complexes and, in particular, the interfacing devices, is the autonomous set-completion block (AKB), a functionally complete unit. The AKB is a self sufficient product and serves as a basic layout unit in the construction of complexes. It is made up of an ensemble of functionally complete system blocks and the base for building up configurations of the interfacing devices is the base ensemble of functional modules. Each AKB of the subsystem has 64 analog input channels. Three expandable configurations can be connected to a single principal configuration. Author

N78-25039# Joint Publications Research Service, Arlington, Va.
POWERFUL LASER IS BEING TESTED **c36**
V. Andriyakhin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 30 (JPRS-70714) 2 Mar. 1978 p 24-31 refs Transl. into ENGLISH from Nauka i Zhizn (Moscow), no. 11, 1977 p 86-90 (For availability see N78-25037 15-99)
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Some of the important features of the LT-1, a 5kW laser, are described. The gas in the working chamber is constantly replaced by a compressor which pumps it around the closed loop of the installation. A cooling system is used to prevent the disappearance of the laser effect due to heating of the gas in the chamber. The resonator is made of four mirrors. The laser beam which leaves the device (one of the mirrors is made with a smaller diameter for this purpose) is focused on the surface to be worked. Movement of the lens allows the size of the spot of the focused beam to be changed smoothly over a board range of sizes, thus controlling the power density. This makes the installation universal, suitable for the performance of all sorts of technological operations. Author

N78-25040# Joint Publications Research Service, Arlington, Va.
ADVANCES IN THE MECHANICS OF GYROSCOPIC AND INERTIAL SYSTEMS **c35**
N. V. Butenin and D. M. Klimov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 30 (JPRS-70714) 2 Mar. 1978 p 32-56 Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 20, no. 10, 1977 p 79-96 (For availability see N78-25037 15-99)
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The following main problems related to inertial navigation systems were posed and solved. (1) Relationships which determine the functioning of a navigation system in the absence of errors were strictly determined. (2) Error equations of the system were found and error analysis was performed. (3) The relationship between inertial navigation systems with dynamometers and classical unperturbed gyropendulum instruments was determined. (4) An investigation was conducted into the problems of using additional information of a noninertial nature to improve the properties of inertial navigation systems and subsequently to develop complex systems. Author

N78-25041# Joint Publications Research Service, Arlington, Va.
PROBLEMS OF THE DEVELOPMENT OF CLOCKS **c35**
Z. M. Akselrod, N. V. Butenin, and B. M. Chernyagin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 30 (JPRS-70714) 2 Mar. 1978 p 57-63 Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 20, no. 10, 1977 p 97-103 (For availability see N78-25037 15-99)
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Studies were conducted on the dynamics of both mechanical and electrical movements of clocks. These studies have led to the development of new designs and methods of engineering calculations of clocks, especially their escapements. Methods and instruments were developed for determining the dynamic parameters of clocks and their parts, facilitating the solution of numerous problems aimed at improving the quality of clocks, and studies were also conducted on the influence of external factors on the mechanism. Work was also done on the theoretical analysis of control time instruments and on the statistical dynamics of clocks and clock systems. Author

N78-25042# Joint Publications Research Service, Arlington, Va.
POSITIONING DRIVE FOR TRANSLATORY MOVEMENTS **c37**
W. Krause and R. Boden *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 30 (JPRS-70714) 2 Mar. 1978 p 64-67 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 20, no. 10, 1977 p 105-106 (For availability see N78-25037 15-99)
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A mechanical drive was developed in which positioning is accomplished by controlling the engagement and disengagement of a clutch with a belt transmission. By using this principle it is possible to develop a clutch for controlling translatory movements. To control positioning, the required direction of translatory movement is attained by engaging the clutch with the upper or lower arm of the belt. The merits of this system are: (1) the simplicity of the reversing method; (2) positioning precision is improved as a result of elimination of the formerly used transmission mechanism and; (3) coupling and brake assemblies are unified. Author

N78-25043# Joint Publications Research Service, Arlington, Va.
THE FIRST TWENTY YEARS OF THE SPACE ERA AND ASTRONOMY **c89**
I. S. Shklovskiy *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 30 (JPRS-707-14) 2 Mar. 1978 p 68-77 Transl. into ENGLISH from Priroda (Moscow), no. 10, 1977 p 86-92 (For availability see N78-25037 15-99)
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The development of space research has led to the appearance of UV, X-ray, and gamma astronomy. The development of exoatmospheric astronomy is the principal gain which astronomy has received from space research. The development of space investigation is affording the possibility of formulating the problem of solar system cosmogony on a truly scientific basis. It is now possible for a detailed comparative analysis of the different planets, especially the planets of the earth group. Other advances in our understanding of astronomy which have resulted from space exploration are enumerated. Author

N78-25044# Joint Publications Research Service, Arlington, Va.
ANNULAR STRUCTURES ON THE EARTH **c46**
V. N. Bryukhanov, M. Z. Glukhovskiy, and A. L. Stavtsev *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 30 (JPRS-707141), 2 Mar. 1978 p 78-93 refs Transl. into ENGLISH from Priroda (Moscow), no. 10, 1977 p 54-65 (For availability see N78-25037 15-99)
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A study of space photographs has shown that annular structures are a characteristic element of the structure of the

planets of the earth group, regardless of the stage of their development. The annular structures developed in the process of formation of the primary basalt crust of the planets and persisted in their primordial form in those places where endogenous and exogenous processes after crustal formation were manifested to an insignificant degree. This information leads to the assumption that the planets of the earth group developed identically in the early stages. Author

N78-25045# Joint Publications Research Service, Arlington, Va.

METALLOGRAPHY OF LUNAR IRON **c91**

Rafail Isaakovich Mints and Tatyana Mikhaylovich Petukhova *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 30 (JPRS-70714) 2 Mar. 1978 p 94-109 Transl. into ENGLISH from Priroda (Moscow), no. 10, 1977 p 66-76 (For availability see N78-25037 15-99)

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Some results of investigations of the larger regolith particles obtained from the lunar surface are discussed. The quantity of metallic particles in each sample is different, but on the average is 0.1 to 0.5%. The form and nature of the surface of lunar metallic particles vary: there are circular particles similar to frozen droplets; there are particles of complex irregular configuration resembling treelike branches and native beads of iron. An interpretation of structures on the basis of a metallographic analysis makes it possible to determine the thermal, mechanical and radiation prehistory of lunar and meteoritic iron. A hypothesis has been proposed which suggests that the lunar continents consist of primary matter. Available experimental data gives basis for assuming that ferronickel fragments of cosmic matter are primary structural elements of the galaxy. Author

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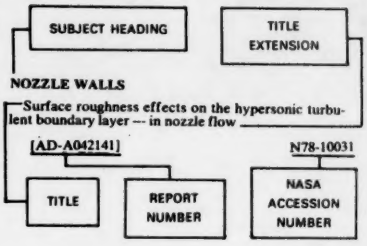
Typical Subject Index Listing



The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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Meteorological data, new series B basic material. Volume 7, no. 1: Aerological data Berlin-Tempelhof, January - June 1976
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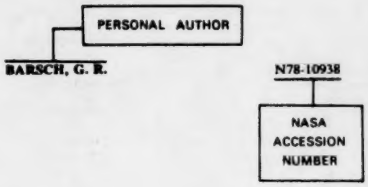

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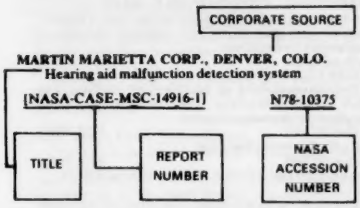

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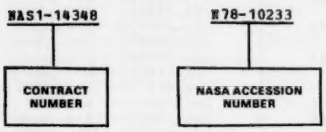

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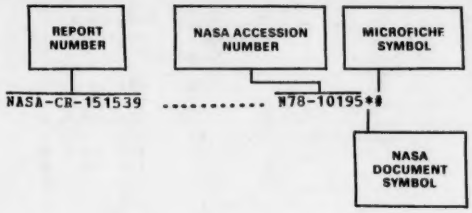

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AAR-126-PT-1 ..... N78-24847 #

AASU-339 ..... N78-24086 #

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AD-A047081 ..... N78-24146 #
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AD-A047357 ..... N78-24766*#
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AD-E000118 ..... N78-24535 #
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AD-E400082 ..... N78-24579 #
AD-E400096 ..... N78-24148 #
AD-E400102 ..... N78-24730 #
AD-E400118 ..... N78-24125 #
AD-E400119 ..... N78-24584 #
AD-E500013 ..... N78-24156 #
AD-E500020 ..... N78-24133 #

ADL-C-79516-F ..... N78-24664 #

AEDC-TR-77-89 ..... N78-24089 #
AEDC-TR-77-107 ..... N78-24904 #
AEDC-TR-78-8 ..... N78-24088 #

AEROCHEM-TN-181 ..... N78-24638*#
AEROCHEM-TN-182 ..... N78-24648*#

AEROCHEM-TP-368 ..... N78-24282 #

AESC-5546 ..... N78-24605 #

AFAPL-TR-77-35-VOL-1 ..... N78-24104 #
AFAPL-TR-77-35-VOL-2 ..... N78-24105 #
AFAPL-TR-77-62 ..... N78-24380*#

AFFDL-TR-77-65 ..... N78-24098 #

AFGL-ERP-612 ..... N78-24875 #
AFGL-ERP-614 ..... N78-24719 #
AFGL-ERP-615 ..... N78-24714 #
AFGL-ERP-616 ..... N78-24723 #
AFGL-ERP-620 ..... N78-24717 #

AFGL-IP-258 ..... N78-24092 #

AFGL-TR-77-0203 ..... N78-24092 #
AFGL-TR-77-0216 ..... N78-24762 #
AFGL-TR-77-0246 ..... N78-24875 #
AFGL-TR-77-0259 ..... N78-24763 #
AFGL-TR-77-0261 ..... N78-24719 #
AFGL-TR-77-0262 ..... N78-24714 #
AFGL-TR-77-0263 ..... N78-24723 #
AFGL-TR-77-0273 ..... N78-24524 #
AFGL-TR-77-0289 ..... N78-24717 #
AFGL-TR-78-0014 ..... N78-25027 #

AFHRL-TR-77-61 ..... N78-24157 #

AFIT-CI-78-19 ..... N78-24372 #
AFIT-CI-78-45 ..... N78-24415 #
AFIT-CI-78-53 ..... N78-24320 #

AFIT-LSSR-23-77B ..... N78-24990 #

AFML-TR-76-81-PT-2 ..... N78-24298 #
AFML-TR-77-95 ..... N78-24342 #
AFML-TR-77-102 ..... N78-24344 #

AFOSR-78-0120TR ..... N78-24094 #
AFOSR-78-0166TR ..... N78-24870 #
AFOSR-78-0197TR ..... N78-24414 #
AFOSR-78-0199TR ..... N78-24850 #
AFOSR-78-0200TR ..... N78-24718 #
AFOSR-78-0201TR ..... N78-24825 #
AFOSR-78-0202TR ..... N78-24813 #
AFOSR-78-0203TR ..... N78-24849 #
AFOSR-78-0207TR ..... N78-24536 #
AFOSR-78-0277TR-PI-1 ..... N78-24847 #
AFOSR-78-0330TR ..... N78-24879 #
AFOSR-78-0350TR ..... N78-24881 #
AFOSR-78-0393TR ..... N78-24852 #
AFOSR-78-0405TR ..... N78-24558*#
AFOSR-78-0468TR ..... N78-24879 #
AFOSR-78-0486TR ..... N78-24894 #
AFOSR-78-0488TR ..... N78-24883 #
AFOSR-78-0492TR ..... N78-24965 #
AFOSR-78-0502TR ..... N78-24961 #
AFOSR-78-0521TR ..... N78-24377 #
AFOSR-78-0536TR ..... N78-24350 #
AFOSR-78-0548TR ..... N78-24376 #
AFOSR-78-0606TR ..... N78-24282 #
AFOSR-78-0670TR ..... N78-24585 #
AFOSR-78-0679TR ..... N78-24150 #
AFOSR-78-0680TR ..... N78-24504 #
AFOSR-78-0681TR ..... N78-24829 #
AFOSR-78-0687TR ..... N78-24825 #
AFOSR-78-0688TR ..... N78-24817 #
AFOSR-78-0689TR ..... N78-24841 #
AFOSR-78-0691TR ..... N78-24873 #
AFOSR-78-0693TR ..... N78-24528 #
AFOSR-78-0694TR ..... N78-24933 #

AFRPL-TR-77-92-VOL-1 ..... N78-24378 #
AFRPL-TR-77-92-VOL-2 ..... N78-24374 #

AGD(RS)4/77 ..... N78-24767 #

AGP-LCC/77/9 ..... N78-24767 #

AI-M-392 ..... N78-24853 #
AI-M-409 ..... N78-24851 #
AI-M-420 ..... N78-24835*#
AI-M-422 ..... N78-24934 #
AI-M-431 ..... N78-24809 #
AI-M-437 ..... N78-24602 #
AI-M-459 ..... N78-24837 #
AI-M-461 ..... N78-24856 #

AI-TR-450 ..... N78-24855 #

AIAA-PAPER-78-1121 ..... N78-24897*#

AIRESEARCH-31-2491B ..... N78-24158 #

AK-7-2201-F ..... N78-24301 #

ALO/3987-1/2-VOL-2 ..... N78-24672 #
ALO/3987-1/3-VOL-3 ..... N78-24673 #

AMMRC-CTR-77-28 ..... N78-24345 #
AMMRC-CTR-77-32 ..... N78-24147 #

AMMRC-MS-78-2 ..... N78-24348 #

AMMRC-TR-78-1 ..... N78-24351 #
AMMRC-TR-78-4 ..... N78-24297 #

AMRL-TR-77-72 ..... N78-24802 #

AMS-TR-1318 ..... N78-24099 #

ANL-TRANS-1109 ..... N78-24561 #

ANL-77-70 ..... N78-24920 #

ANL/NSD/FE-77-4 ..... N78-24559 #

AR-1 ..... N78-24312 #
AR-68 ..... N78-25030 #
AR-000-881 ..... N78-24516

ARAP-316-PT-1 ..... N78-24316 #
ARAP-331 ..... N78-24044*#
ARAP-332 ..... N78-24504 #

ARBRL-MR-02808-PT-1 ..... N78-24095 #

ARBRL-TR-02038 ..... N78-24467 #

ARCSL-CR-77027 ..... N78-24319 #
ARCSL-CR-77057 ..... N78-24318 #

ARCSL-TR-78014 ..... N78-24730 #

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